Structural Assessment of Plaquemines Parish, Louisiana After Hurricane Katrina

by

Structural Safety Assessment –
Planning and Response Team

U.S. Army Corps of Engineers

Buffalo District & Huntington District

11/6/05 – 11/28/05

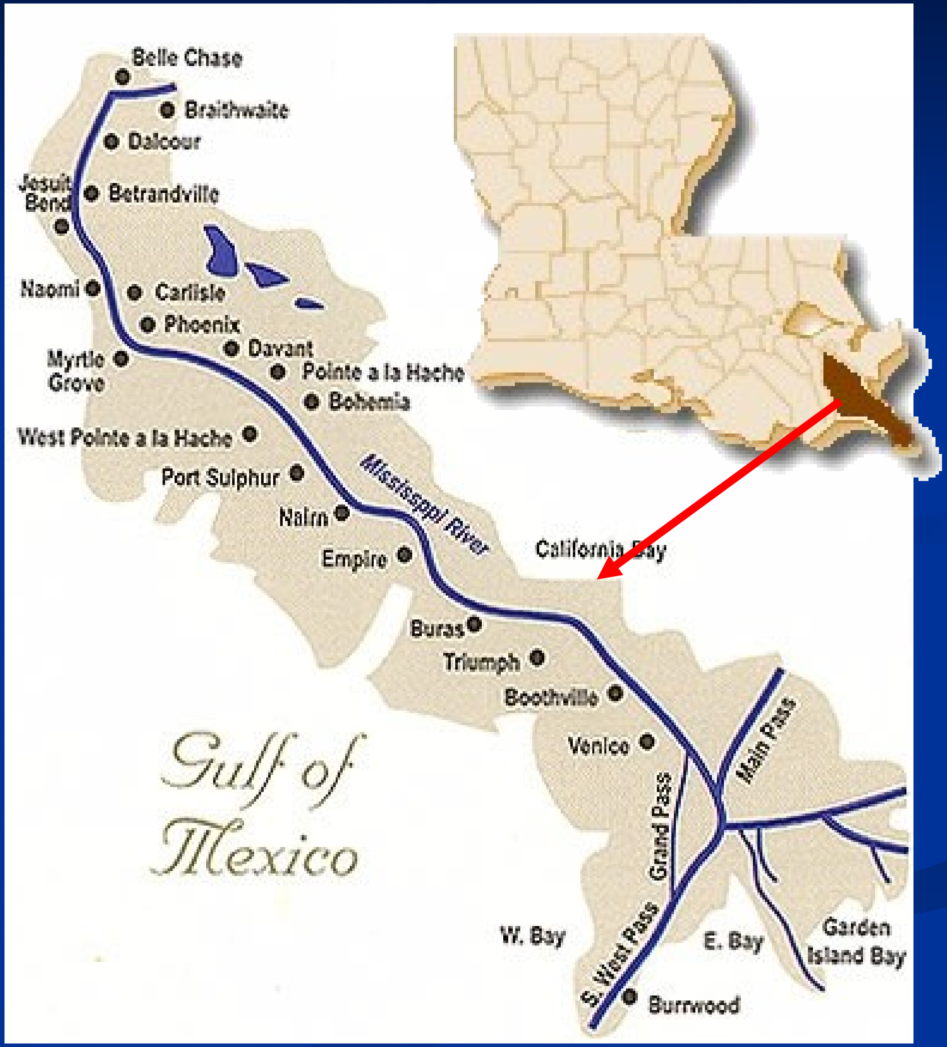
SSA-PRT Plaquemines Parish

Introduction

- Plaquemines Parish general information
- Hurricane Katrina and Rita data
- Post Katrina and Rita damage
- Explain assessment process
- Give examples of assessments
- Show results from mission
- Lessons learned

SSA-PRT Plaquemines Parish

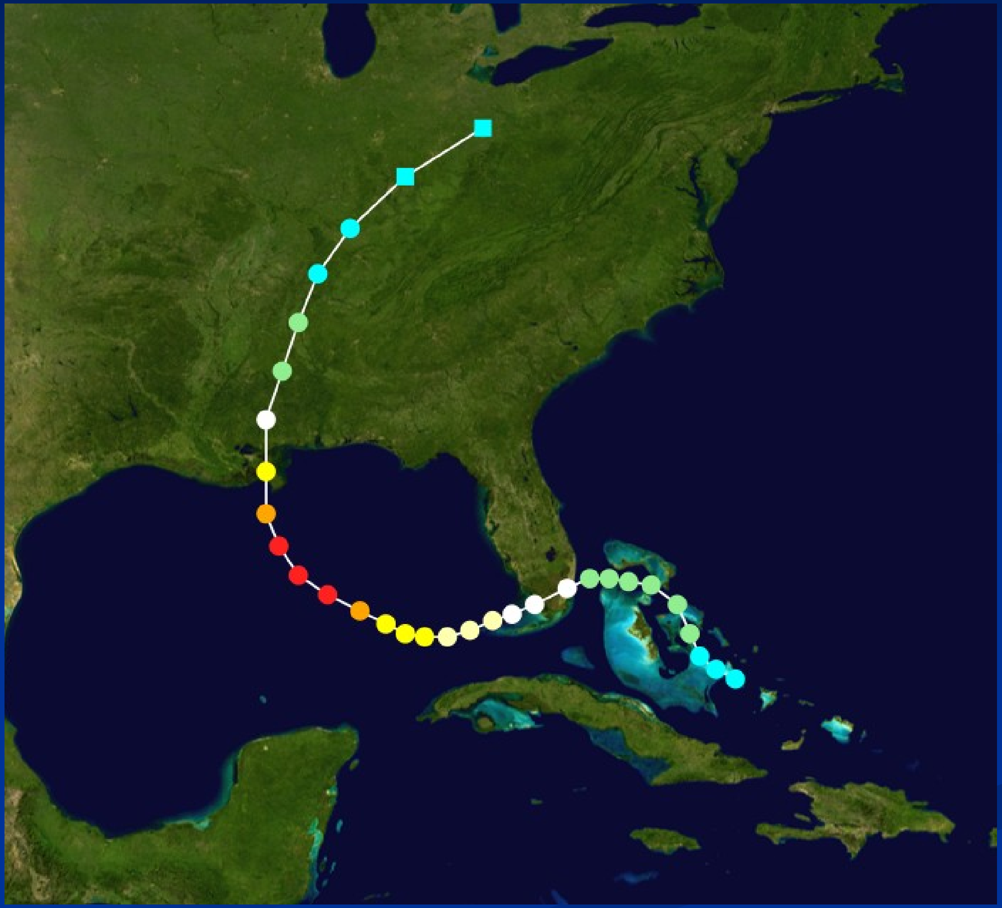
- Plaquemines is Louisiana’s southernmost parish where the Mississippi River meets the Gulf of Mexico
- The parish has a population of approximately 27,000, a land area of 845 square miles, and is approximately 65 miles long and ¾ mile wide at its widest point
- The parish main sources of income are from fishing, recreation and oil


Belle Chase
Braithwaite
Dalcour
Jesuit Bend
Betrandville
Naomi
Carlisle
Phoenix
Myrtle Grove
Davant
Pointe a la Hache
Bohemia
West Pointe a la Hache
Port Sulphur
Mississippi River
Nairn
Empire
California Bay
Buras
Triumph
Boothville
Venice
Main Pass
Grand Pass
Gulf of Mexico
W. Bay
S. West Pass
E. Bay
Garden Island Bay
Burrwood

SSA-PRT Plaquemines Parish

Hurricane Katrina

- Made landfall on August 29th, 2005 as a Category 3 (was Category 5) storm with winds up to 125 mph and a storm surge of up to 22 ft
- Caused an estimated $75 billion in damages (costliest hurricane in U.S. history)
- Killed 1,418 people (deadliest hurricane since 1928)



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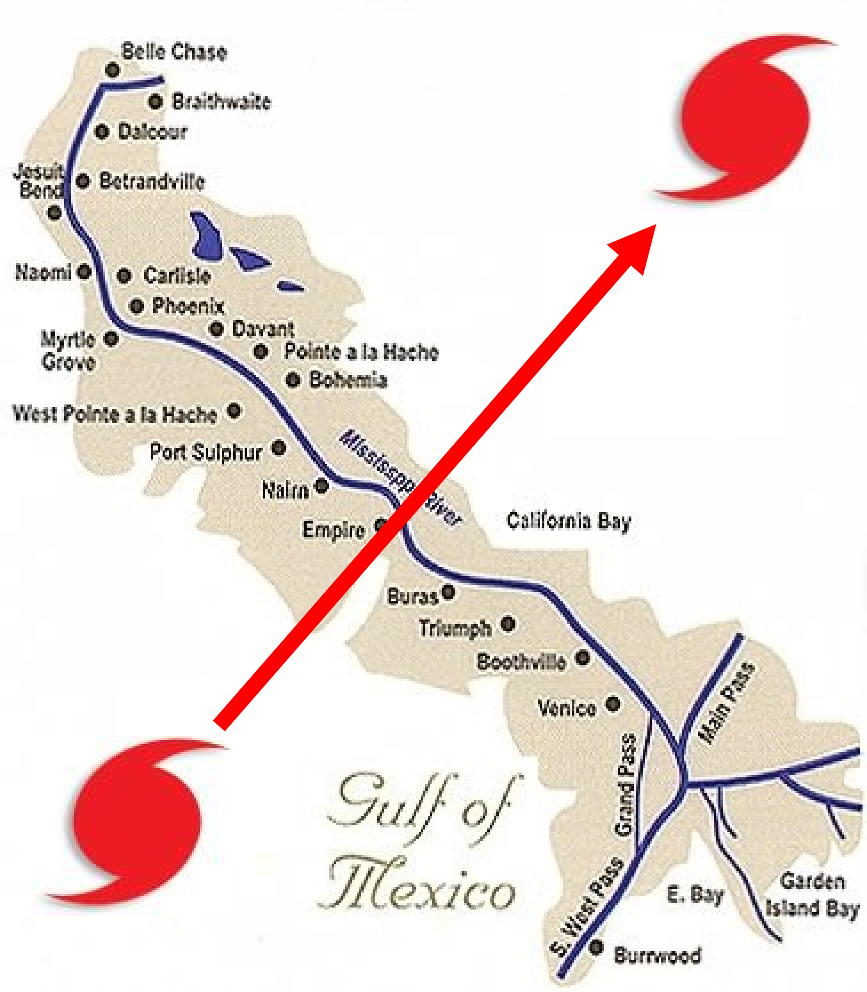
- The eye of Hurricane Katrina passed directly through the middle of Plaquemines Parish
- Plaquemines was also affected by Hurricane Rita
- Levees run on either side of the Mississippi River as well as along Gulf side of the parish
- Overtopping of Mississippi River caused levee failure, surge damage and flooding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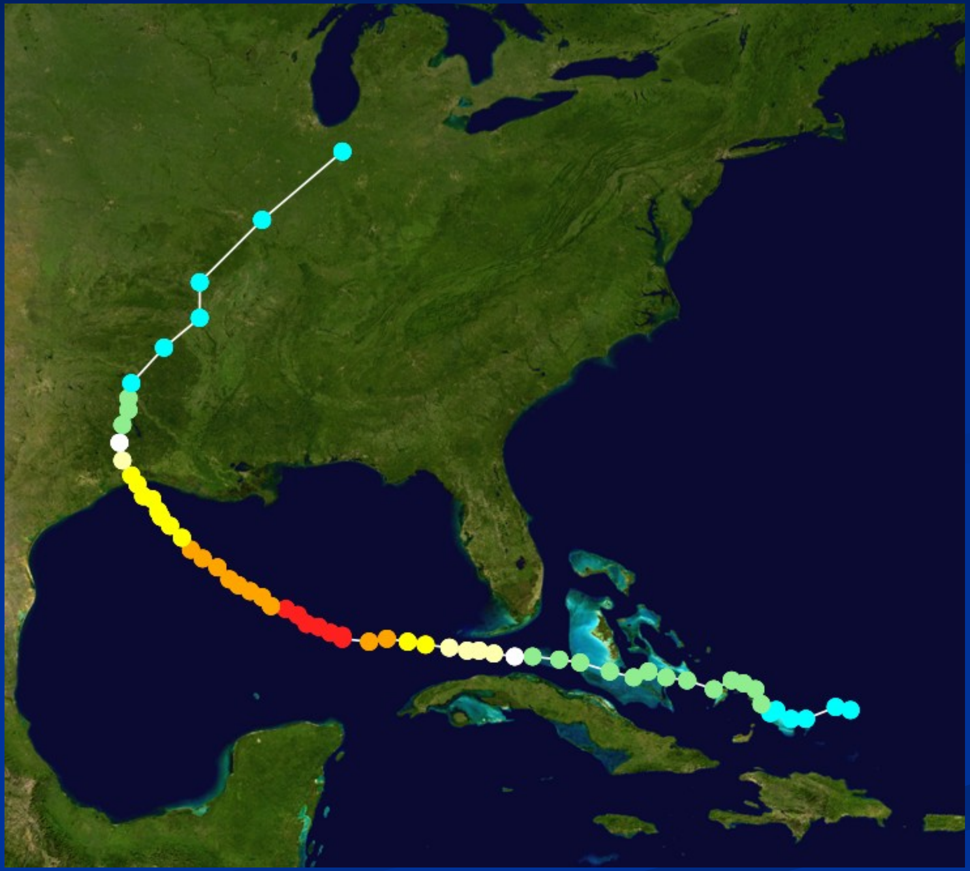
Hurricane Rita

- Made landfall on September 24, 2005 as a Category 3 (was Category 5) with winds up to 125 mph and a 7 ft storm surge in Texas (15-20 ft in Louisiana)
- Caused an estimated $9 billion in damages
- Killed 6 people directly and 113 indirectly
- Re-flooded parts of Louisiana hit by Katrina



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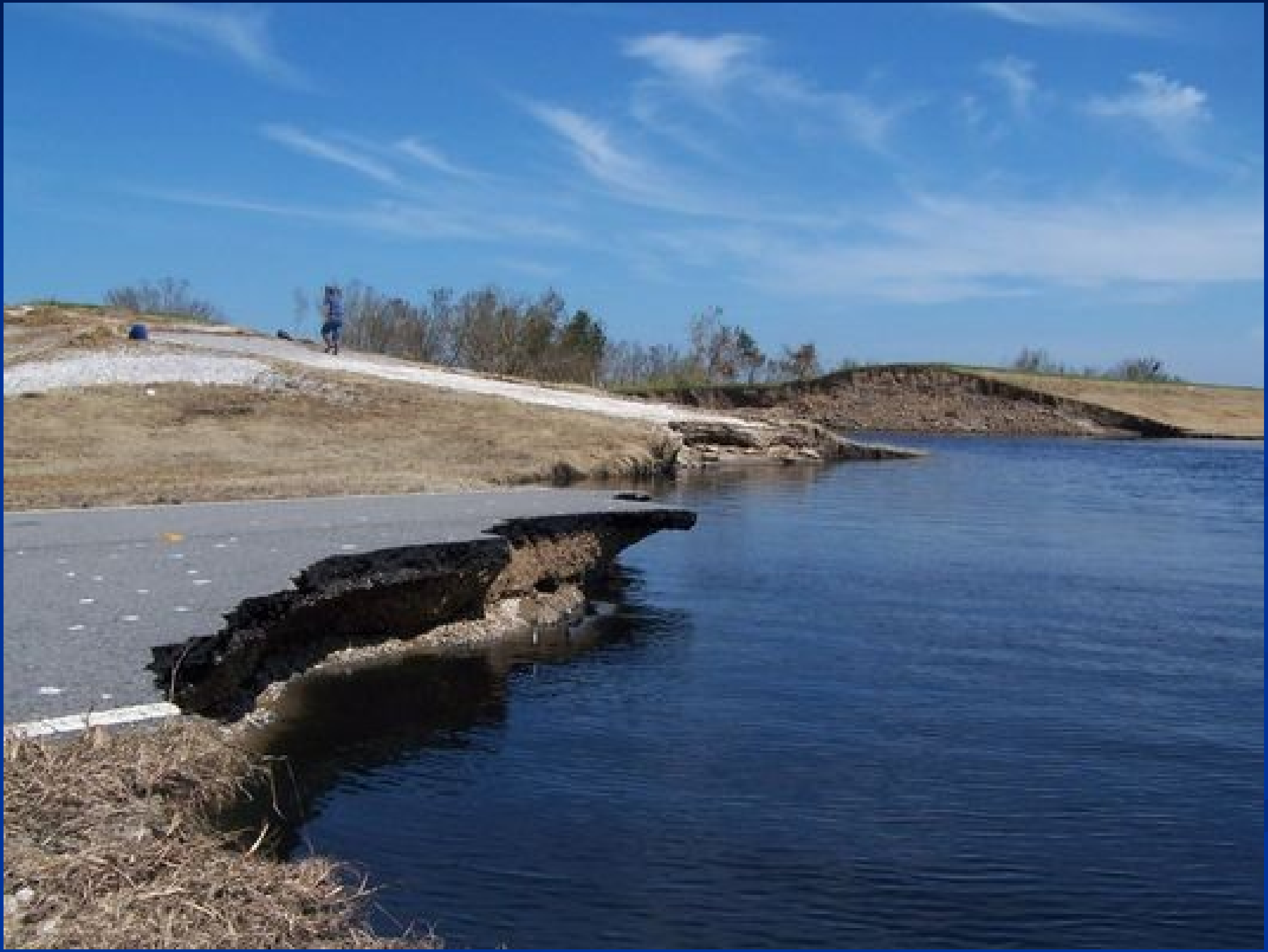
Levee Break



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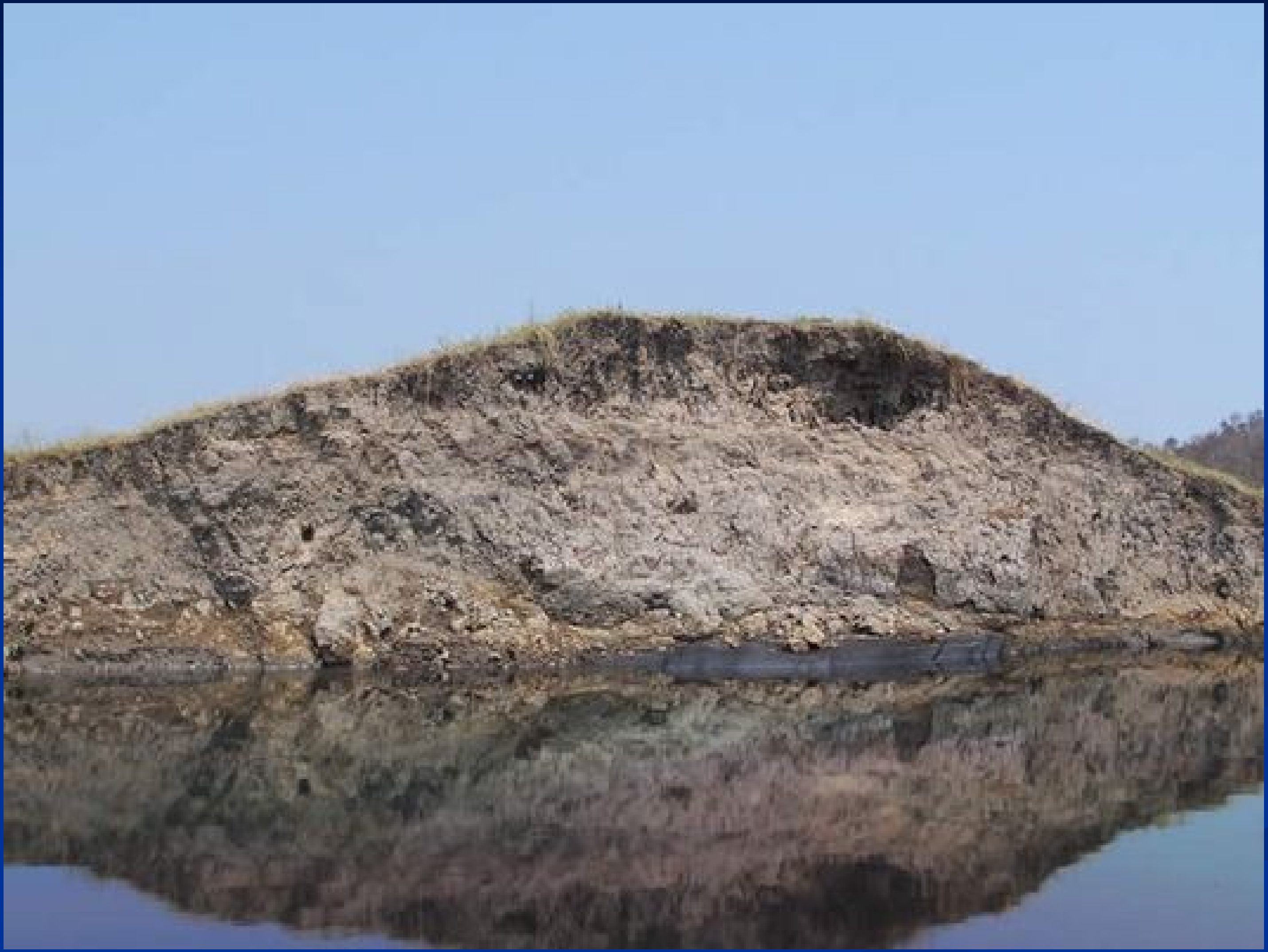
Levee Cross Section



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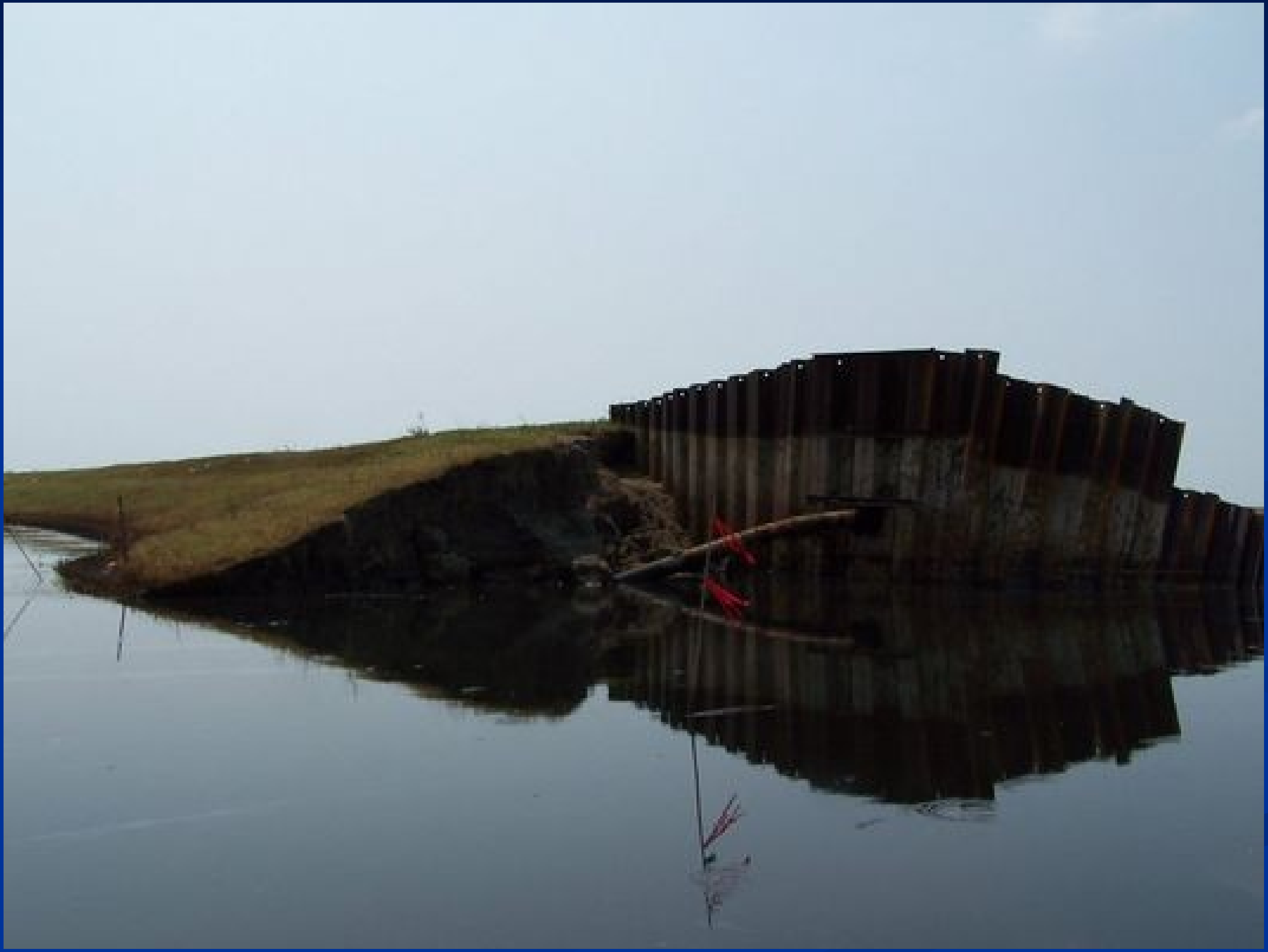
Levee Break



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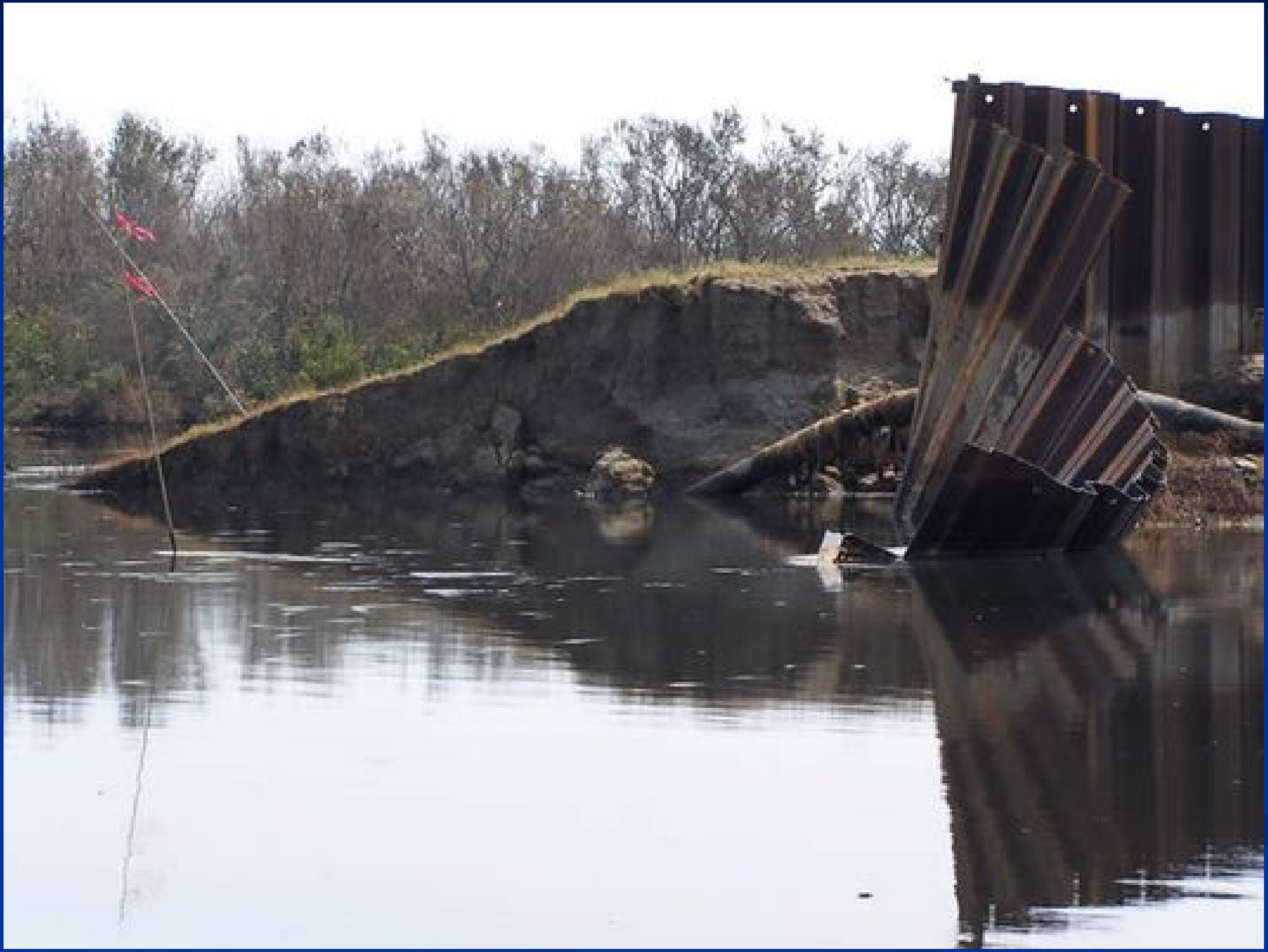
Levee Break



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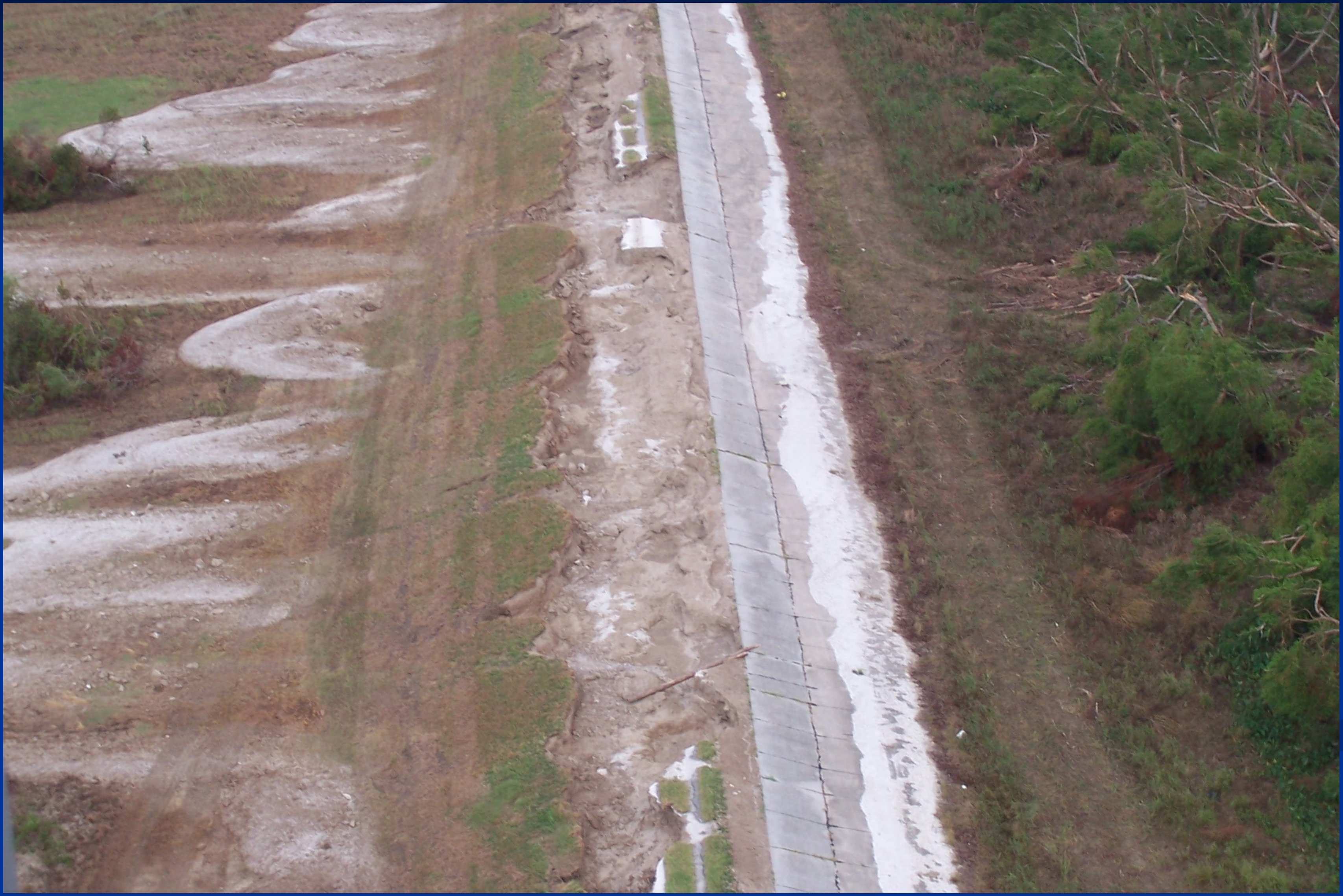
Levee Break



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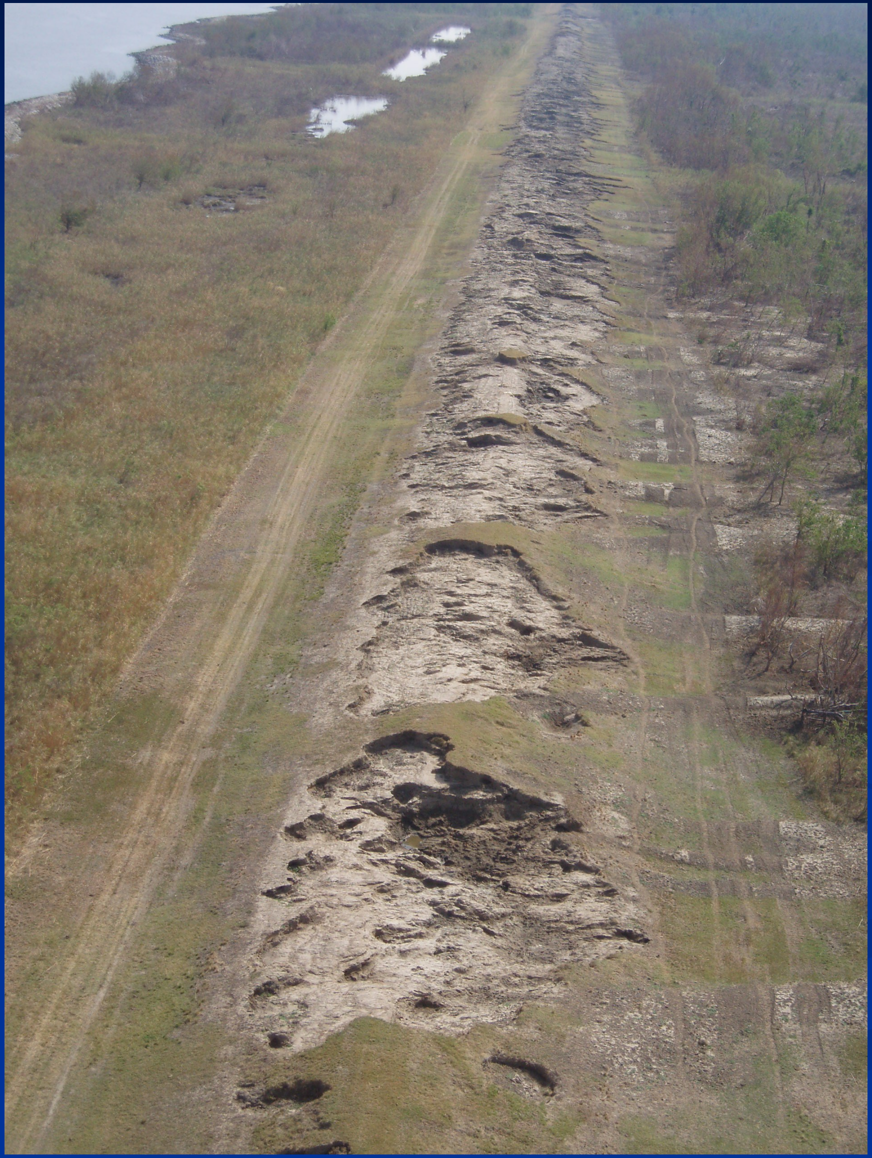
Levee Break



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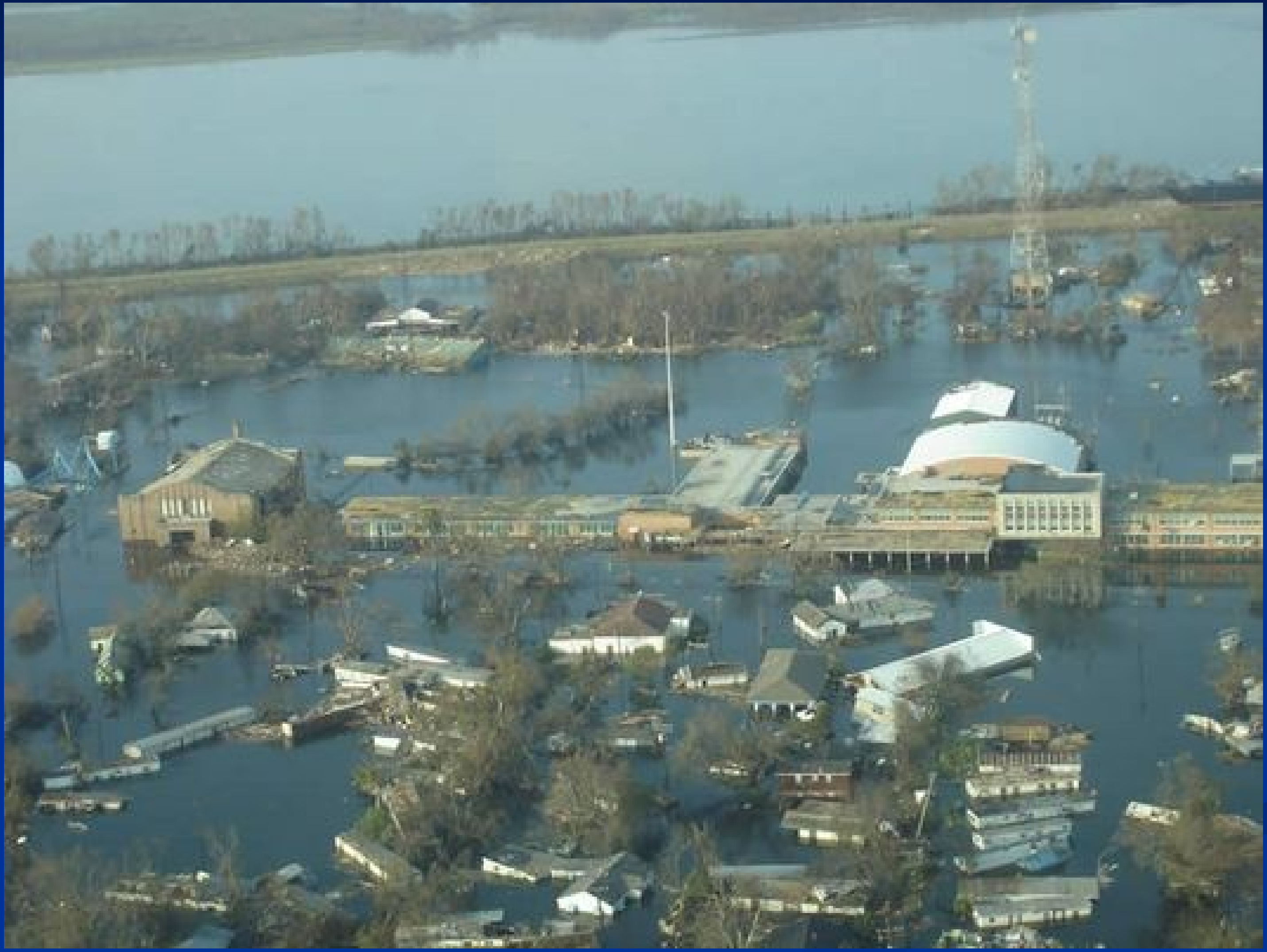
Buras High School



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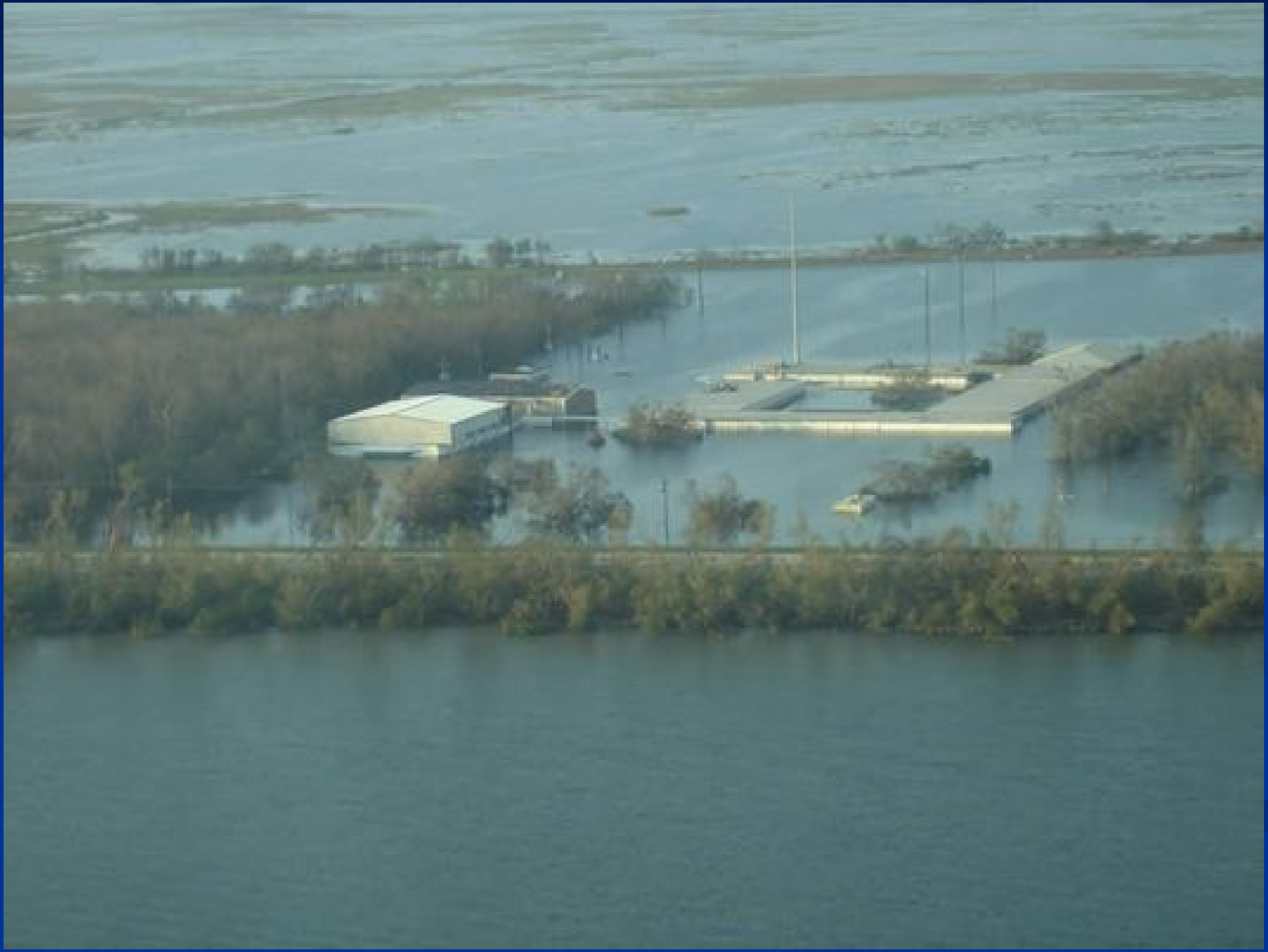
Parish Prison



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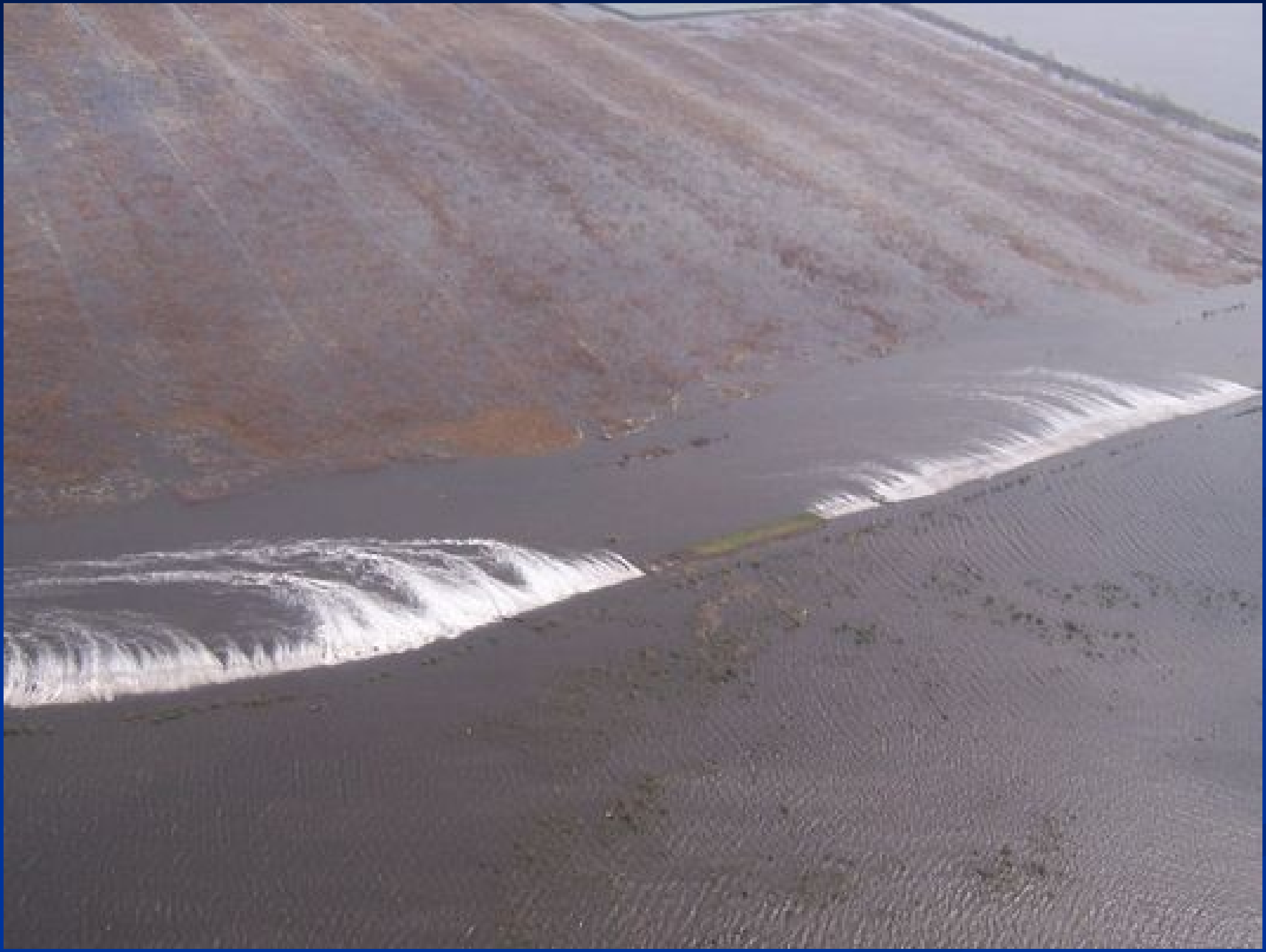

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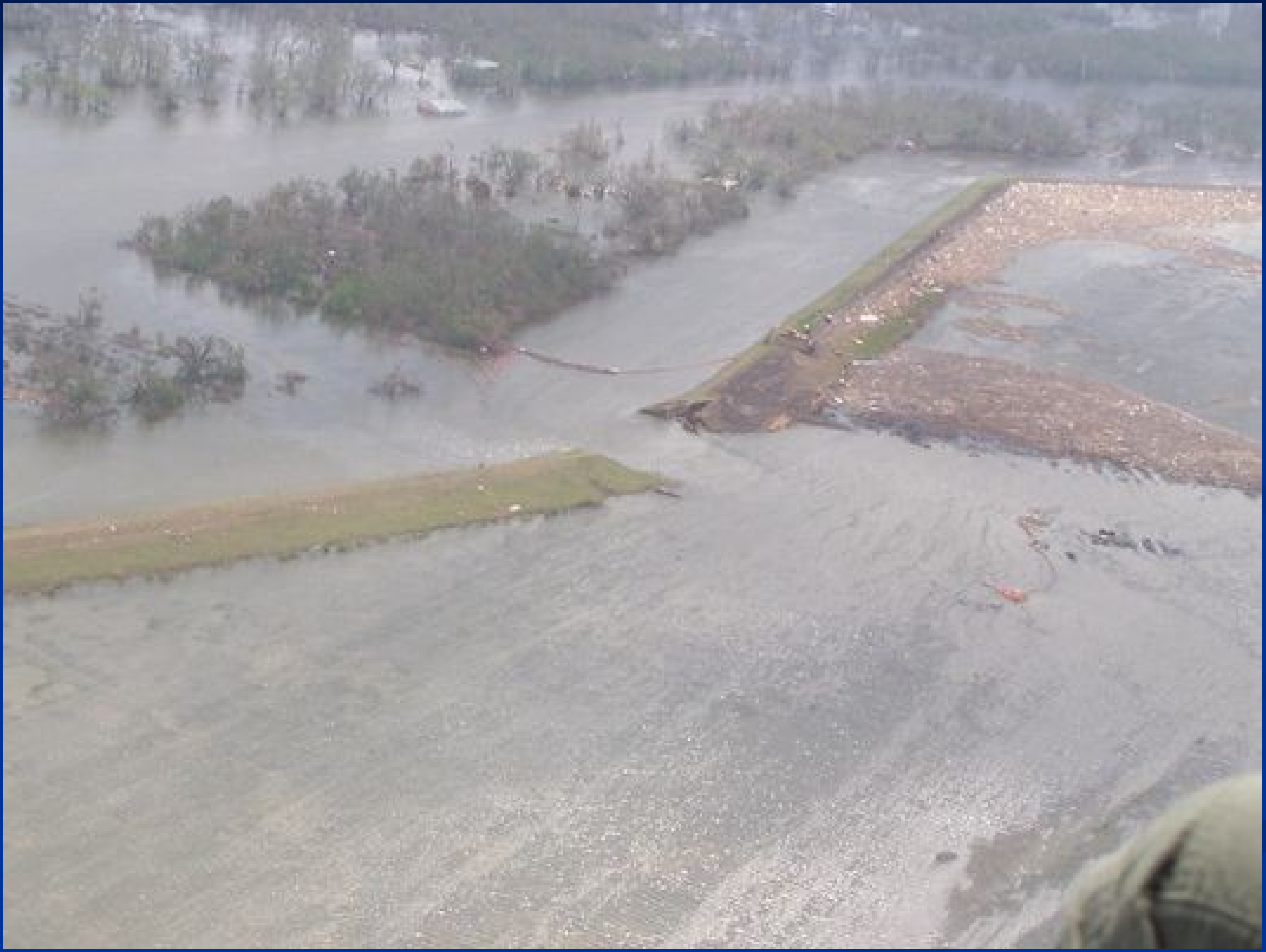

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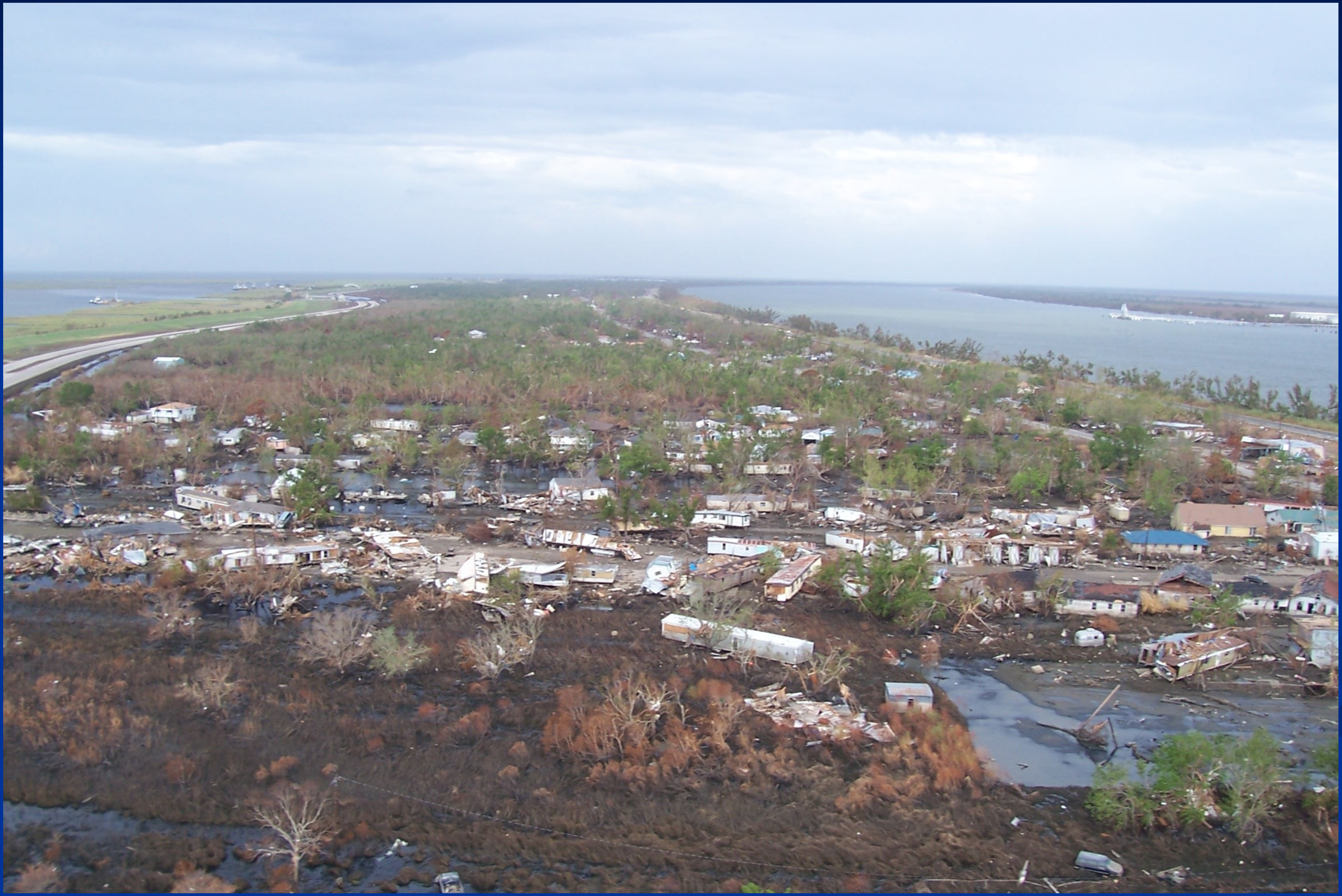

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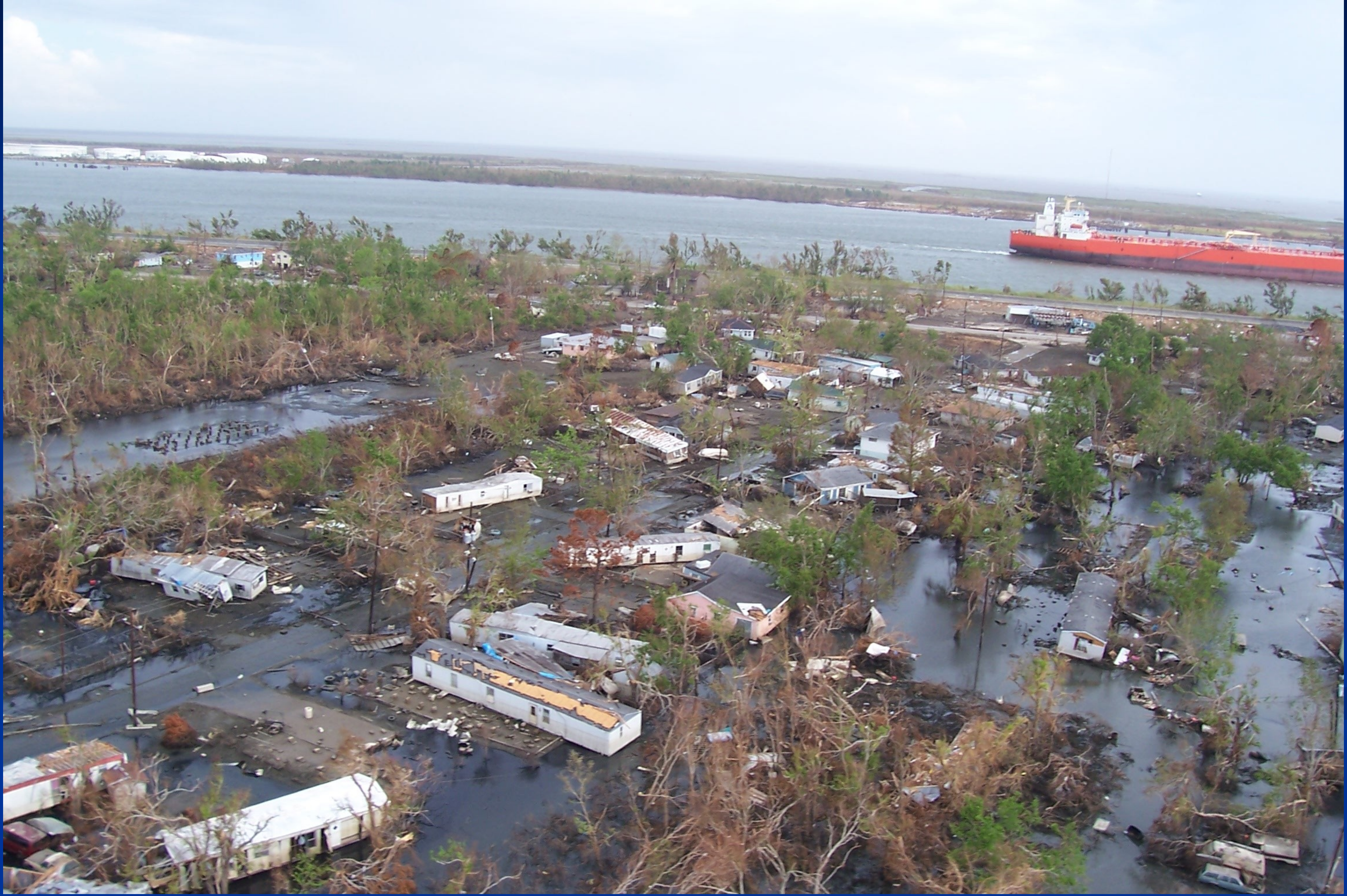

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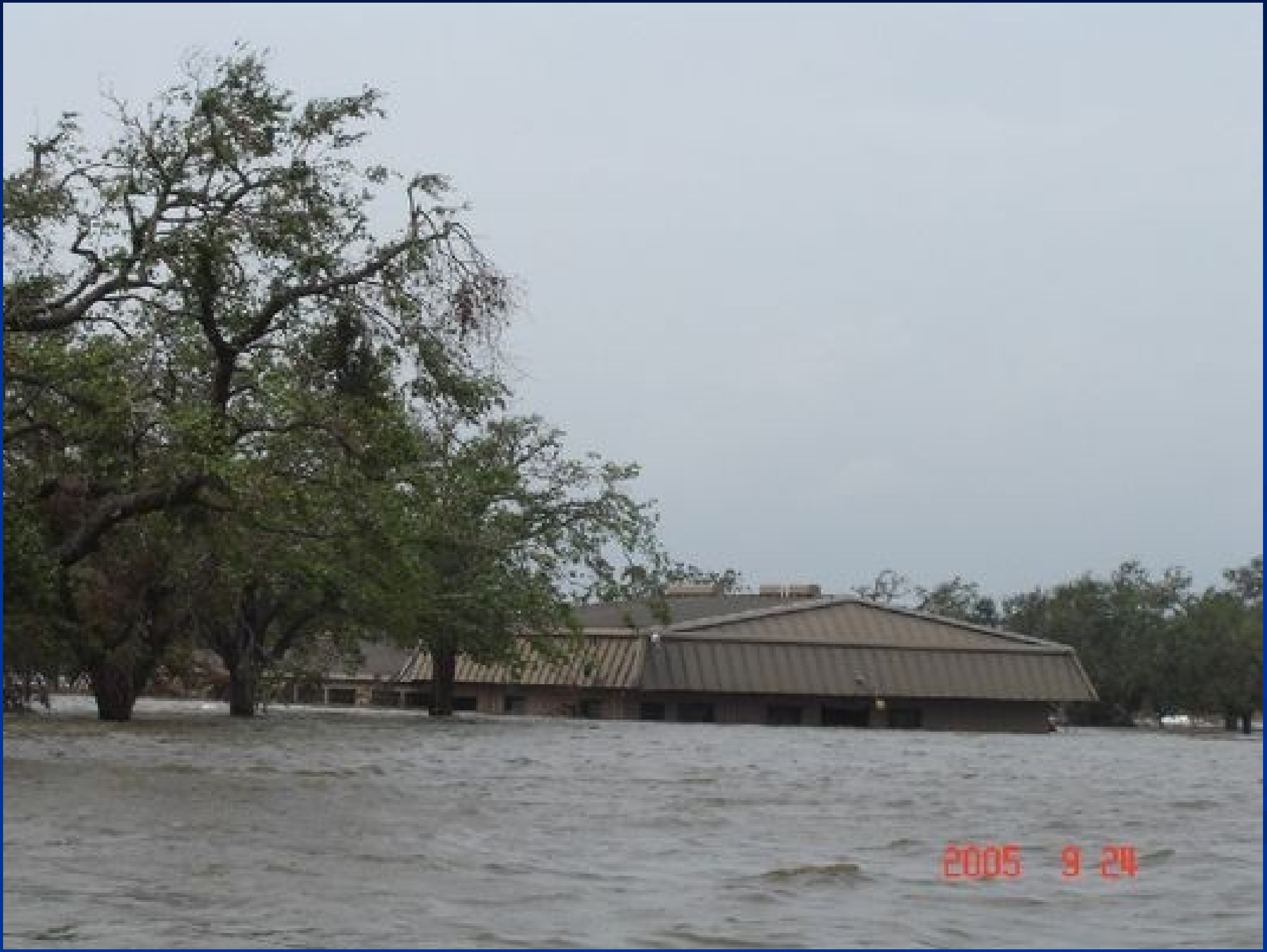

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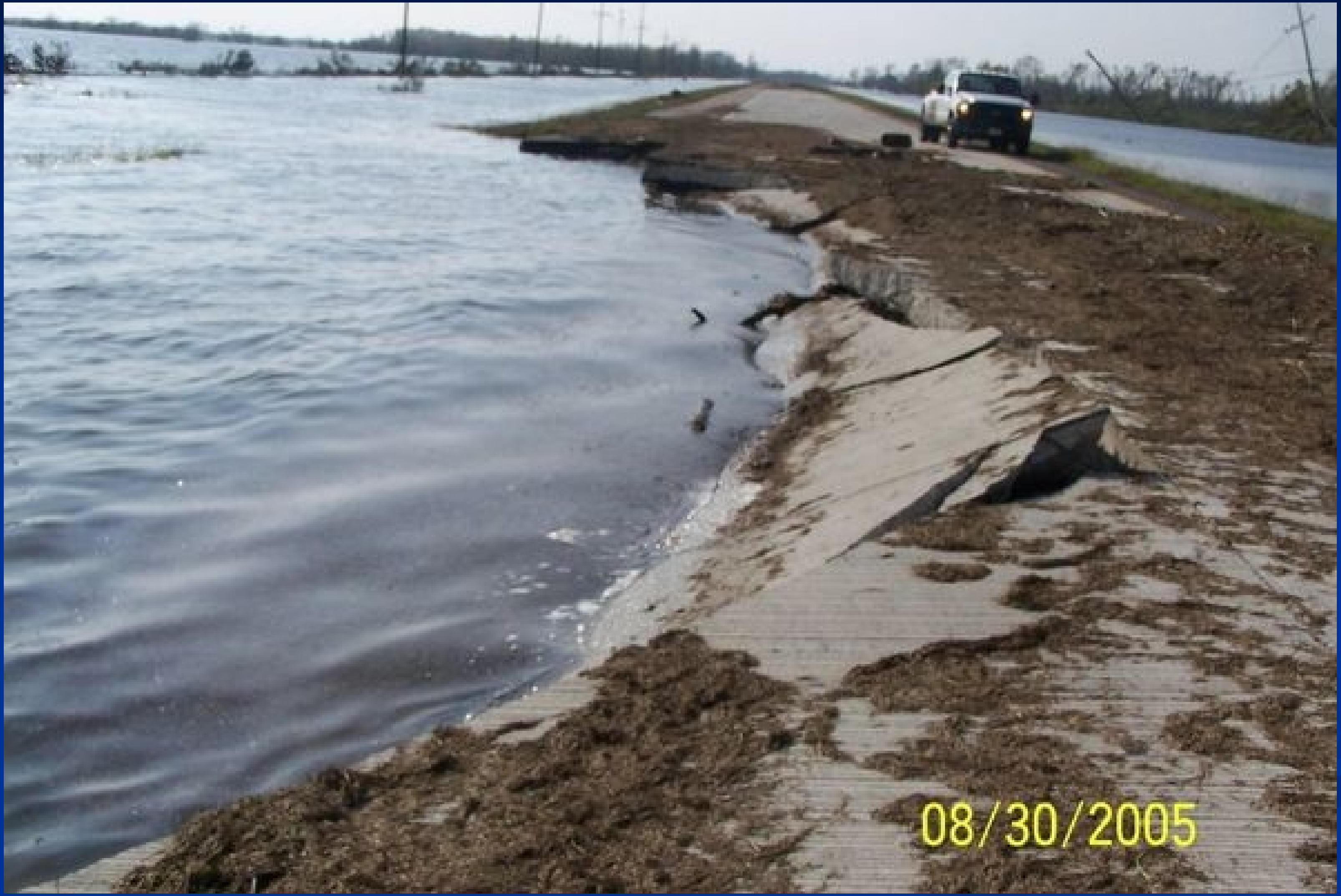

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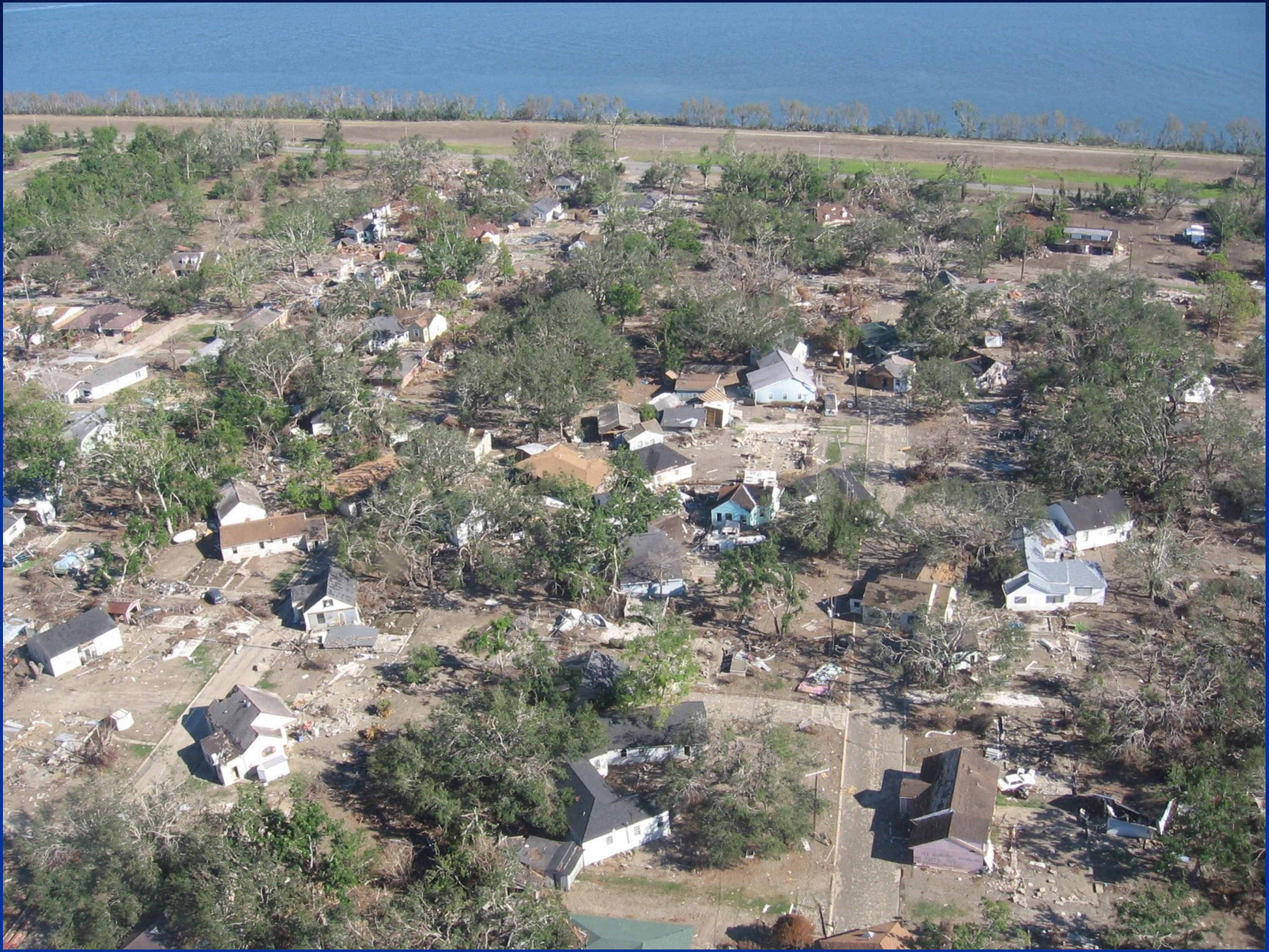

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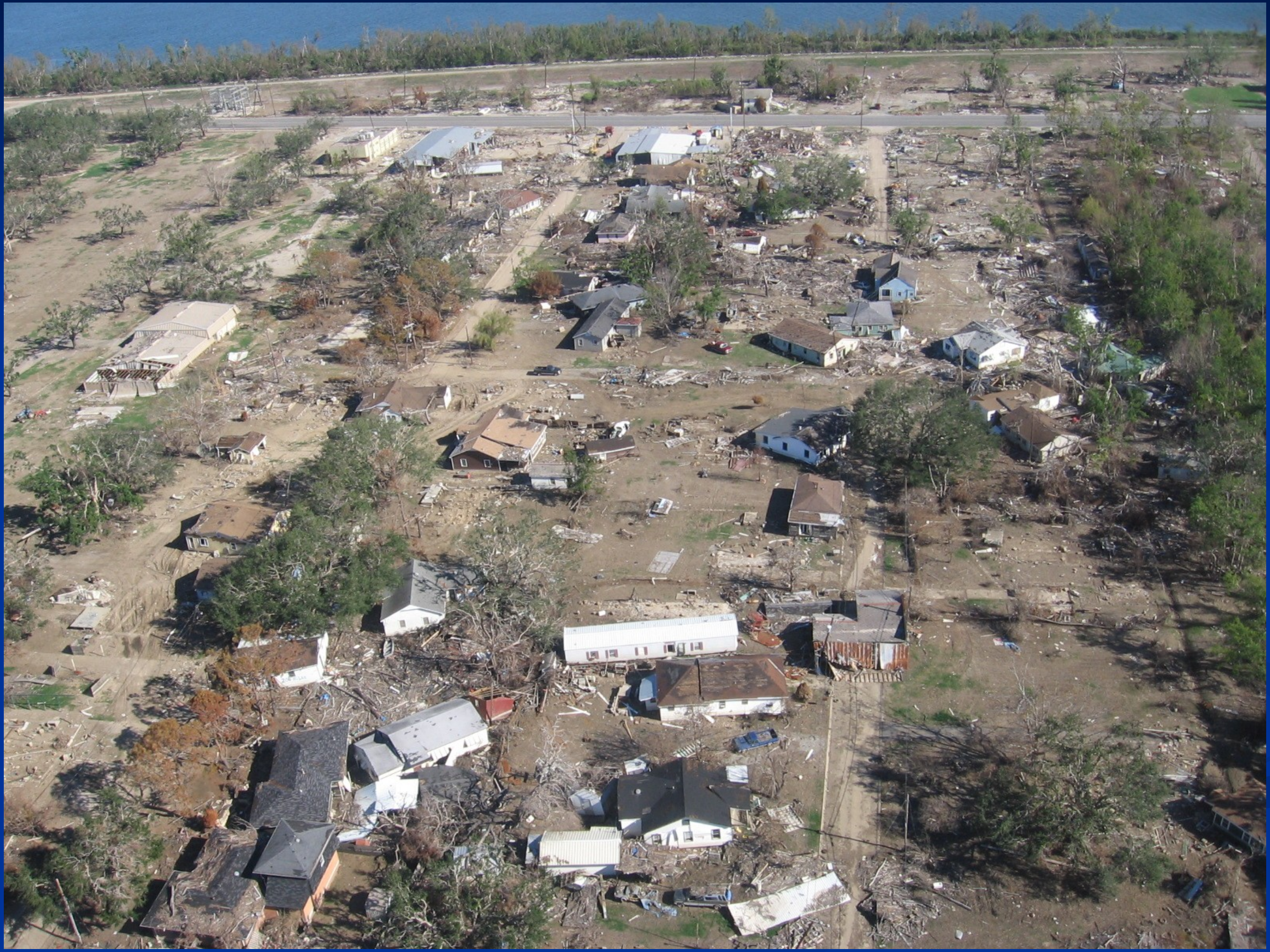

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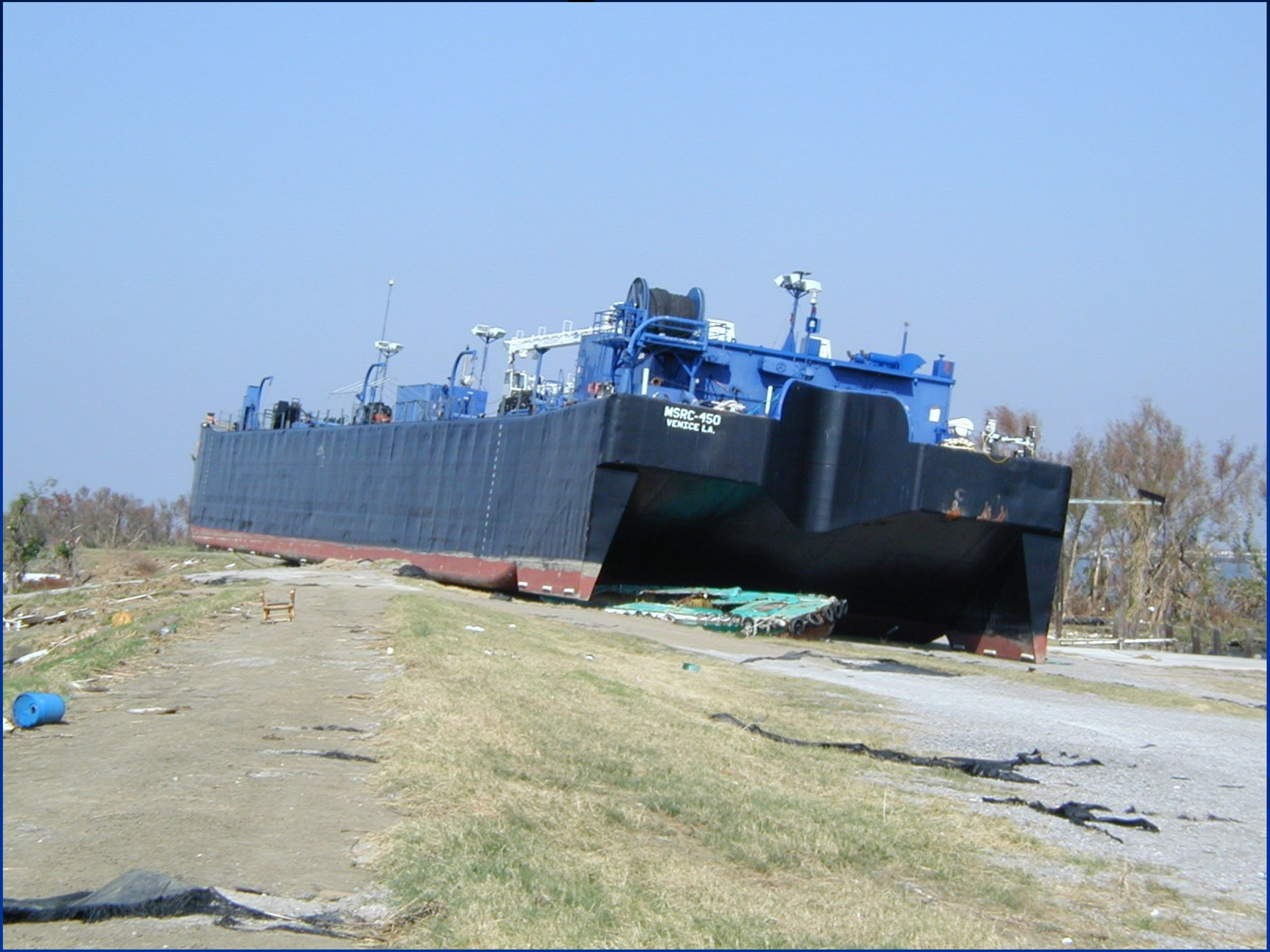
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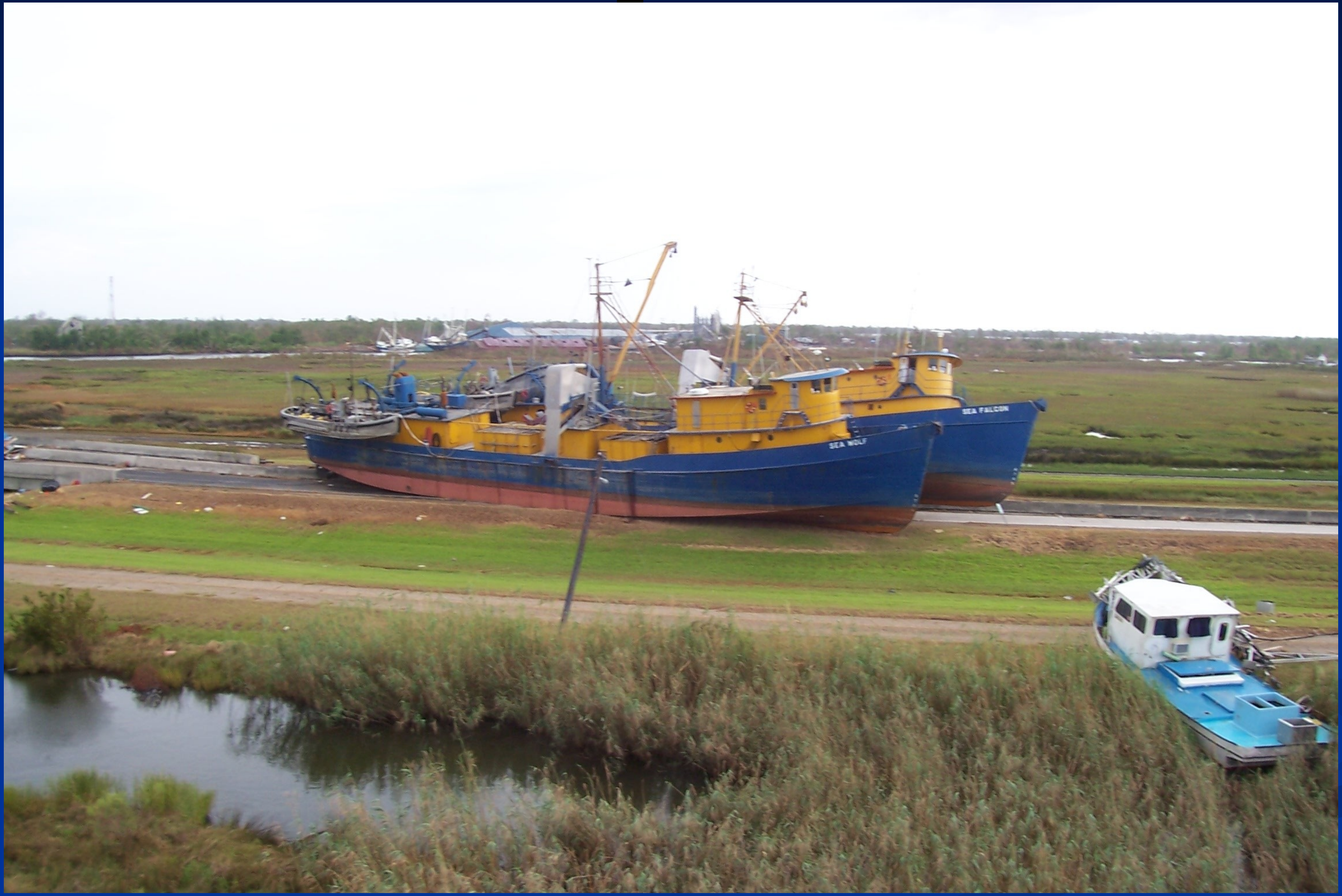
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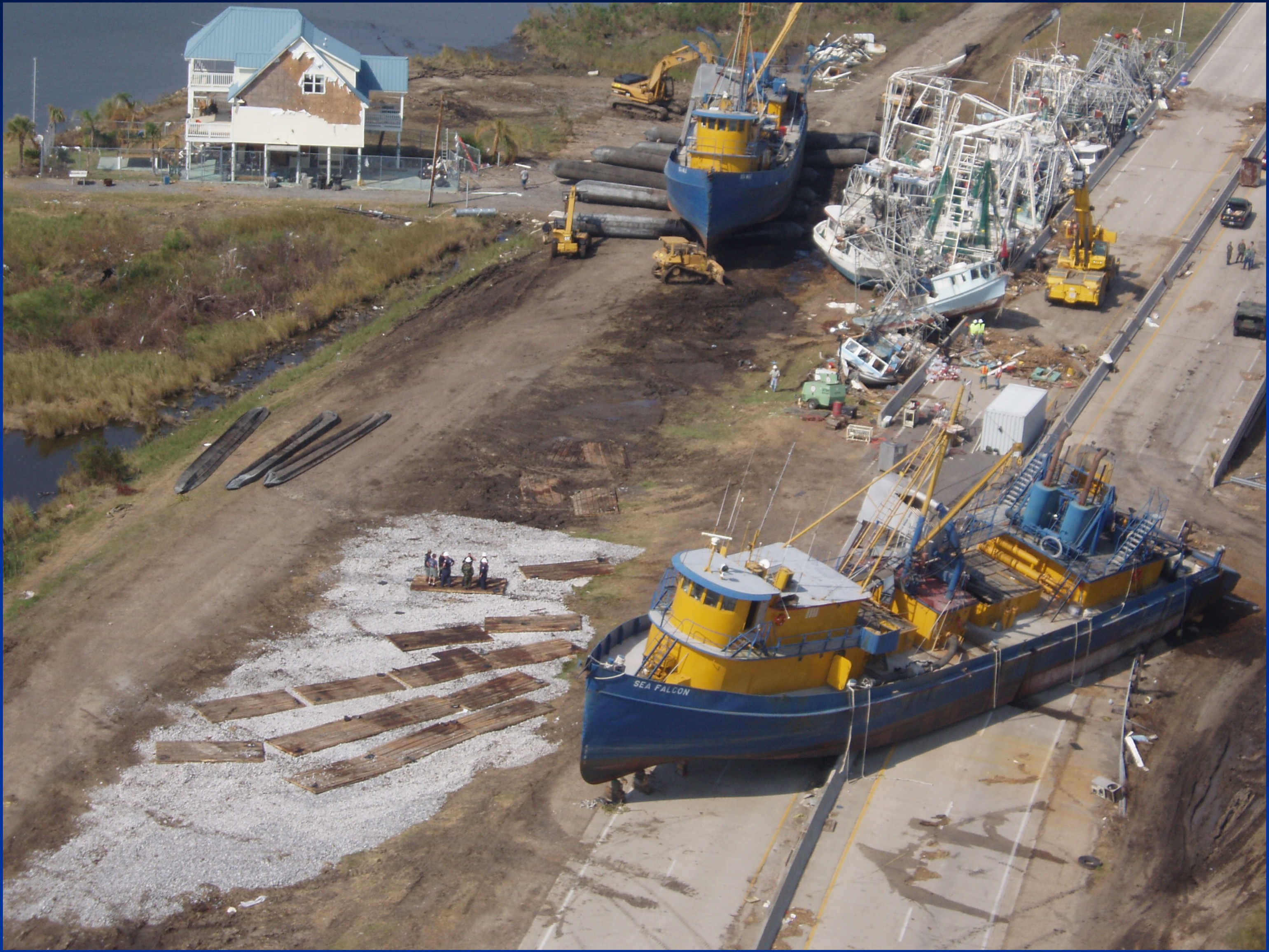

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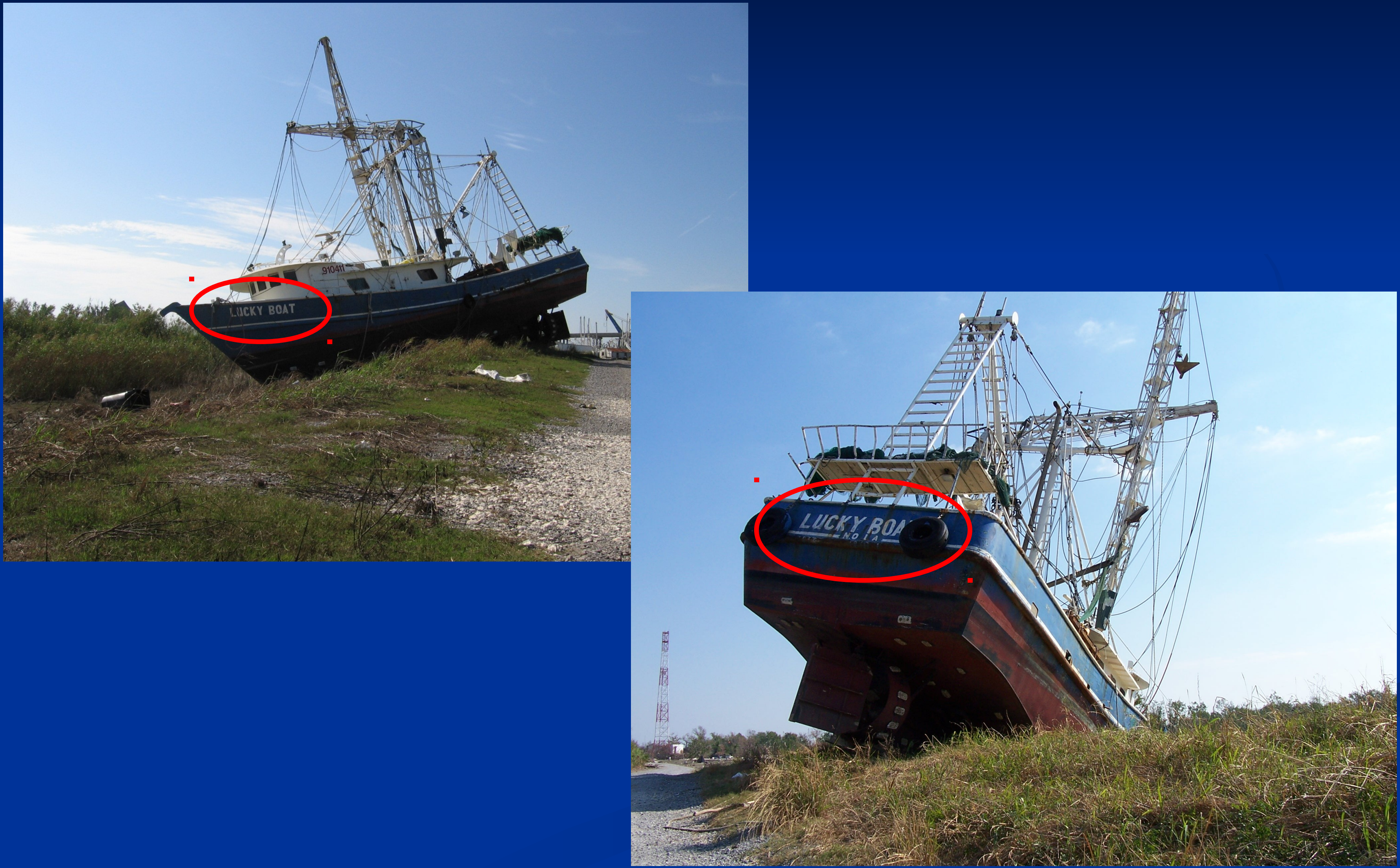
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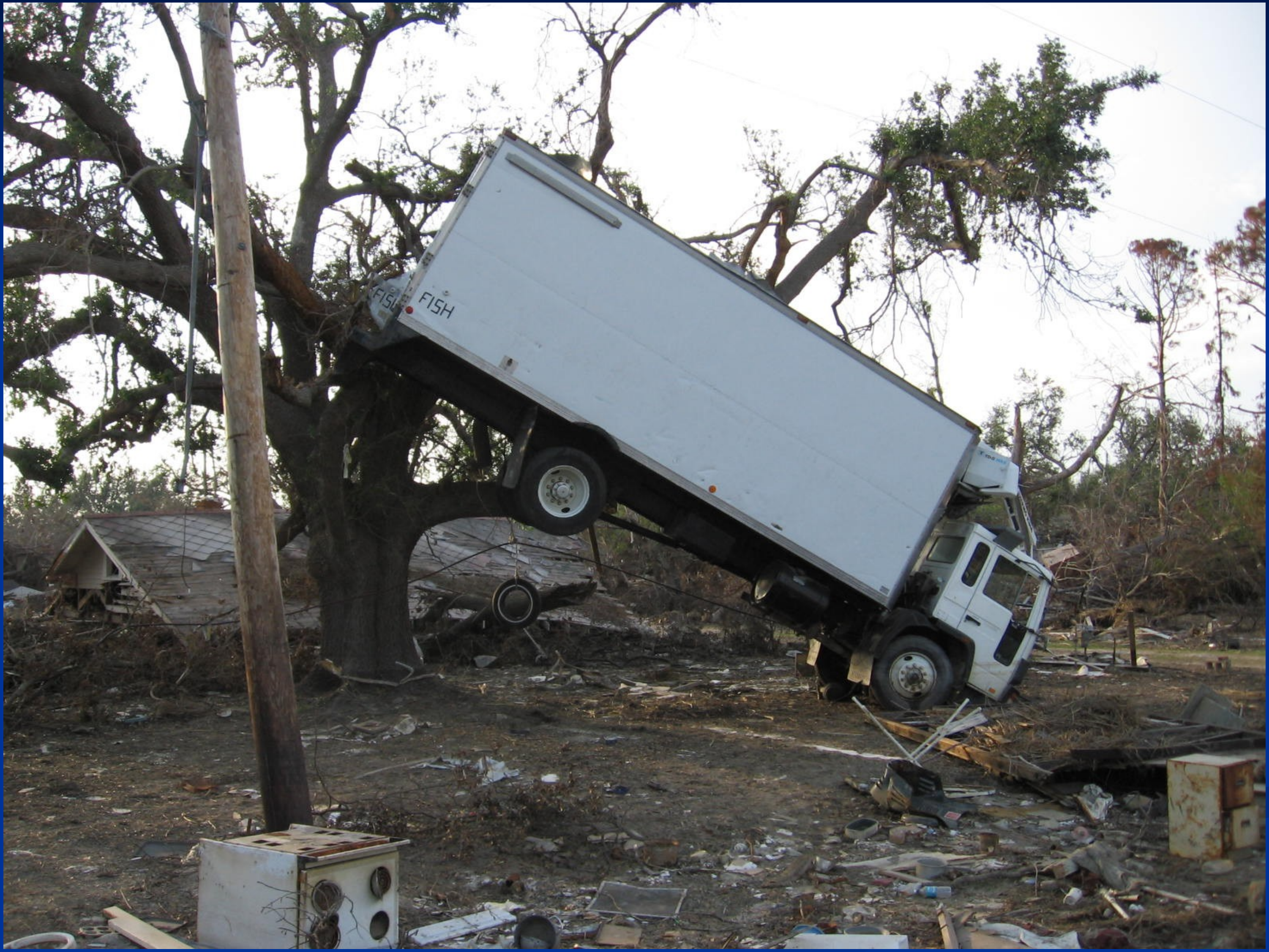

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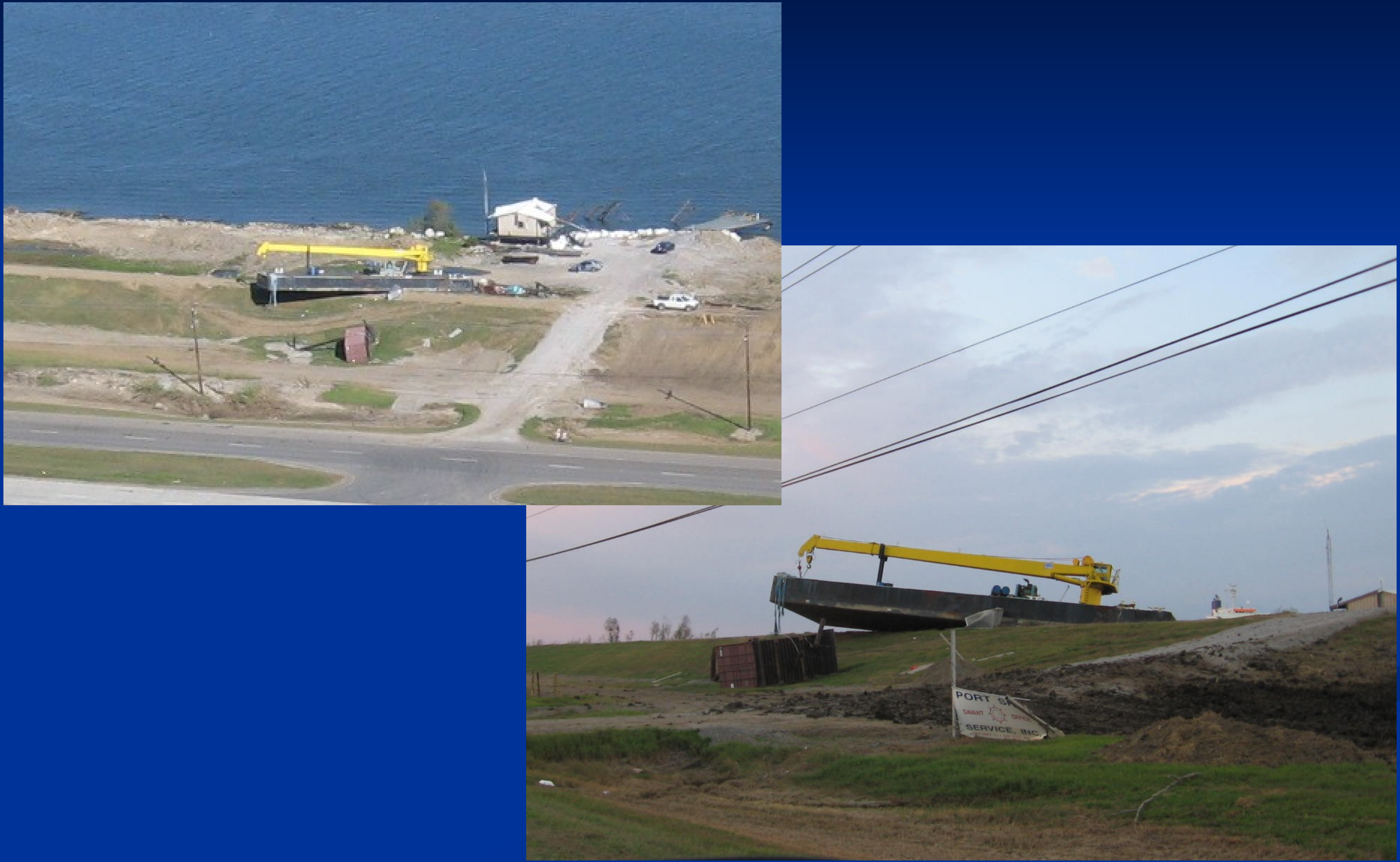
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SERVICE, INC.

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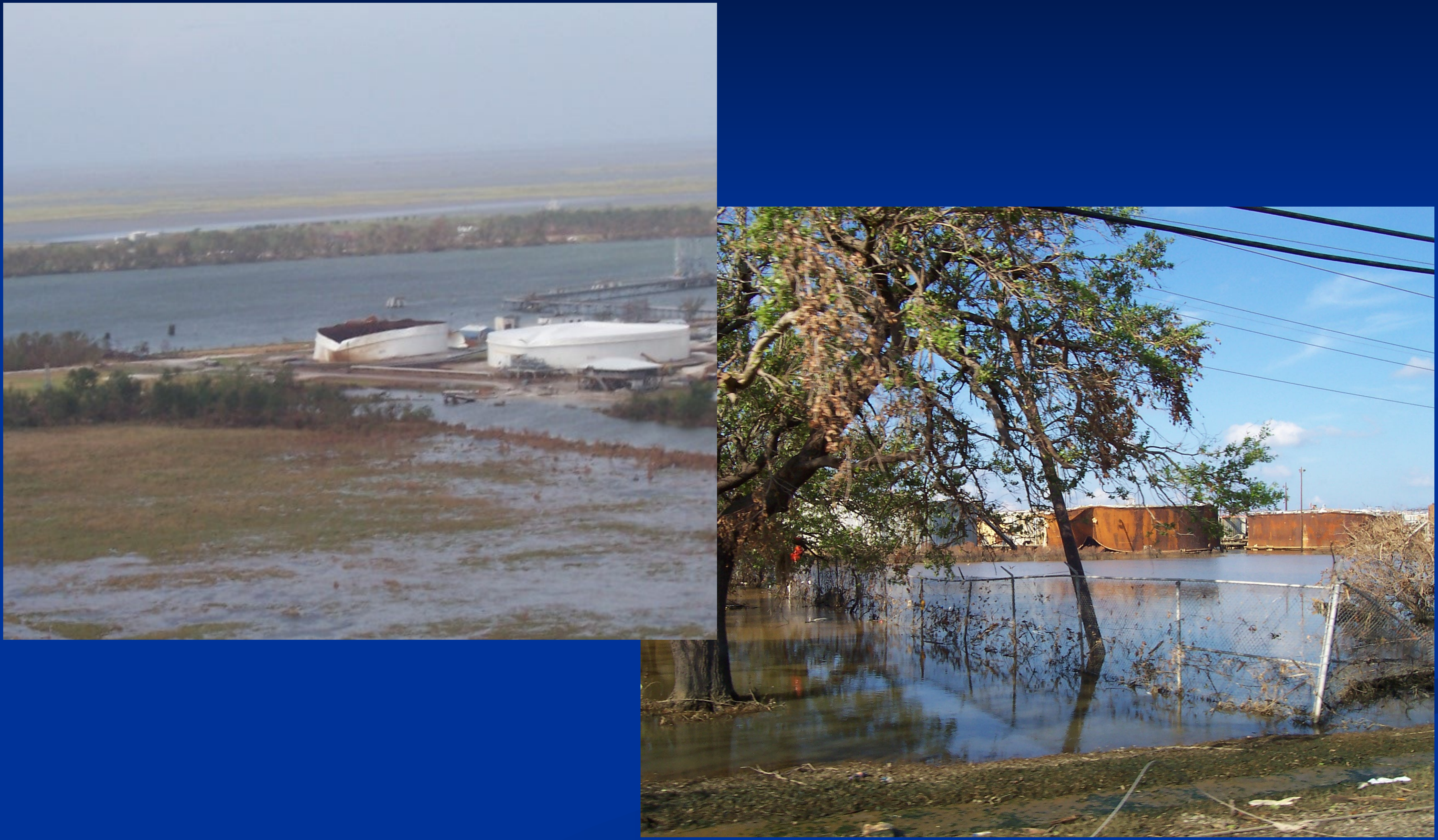

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Task:

- “Structural Assessment Team – Requesting Corps of Engineers Structural Safety Assessment Team for Plaquemines Parish to assess structural integrity of public (PA) and residential (IA) property. Approximately 4500 structures. Need to identify those structures which may be feasibly repaired or require demolition.”
- Actually 6500 inspections done
- Public property (i.e. government buildings, schools, etc.) was later taken off of mission statement
- Some commercial structures were evaluated if Right-of-Entry was obtained and inspection requested

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ASSESSMENT PROCESS

- Rapid Assessments
- Visual Assessments
- Obtain Rights of Entry (R.O.E.)
- Detailed Residential Assessments
- Detailed Commercial Assessments
- Determine if "**Structure Appears Sound**", "**More Investigation Needed**", or "**Structure Appears Unsound**"

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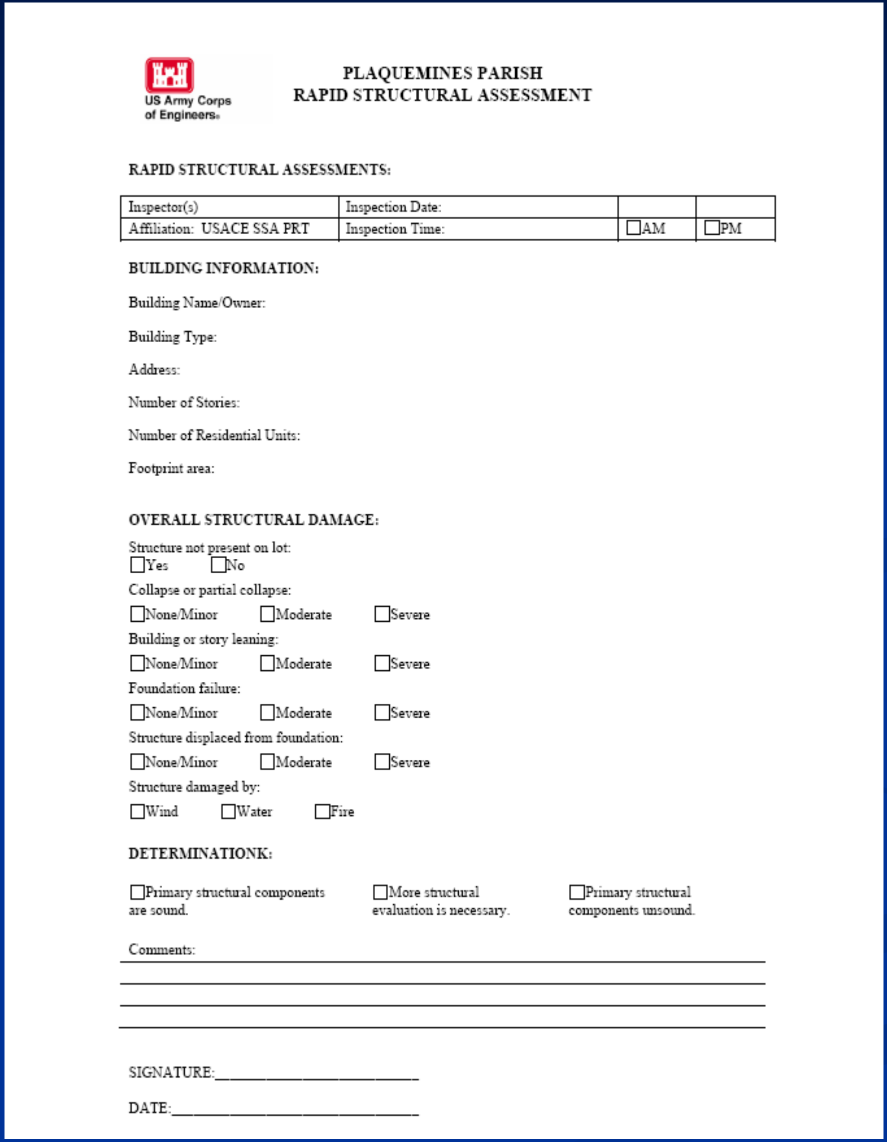
Rapid Assessment



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PLAQUEMINES PARISH
RAPID STRUCTURAL ASSESSMENT

RAPID STRUCTURAL ASSESSMENTS:

Inspector(s)	Inspection Date:		
Affiliation: USACE SSA PRT	Inspection Time:	☐AM	☐PM

BUILDING INFORMATION:

Building Name/Owner:

Building Type:

Address:

Number of Stories:

Number of Residential Units:

Footprint area:

OVERALL STRUCTURAL DAMAGE:

Structure not present on lot:
☐Yes ☐No

Collapse or partial collapse:
☐None/Minor ☐Moderate ☐Severe

Building or story leaning:
☐None/Minor ☐Moderate ☐Severe

Foundation failure:
☐None/Minor ☐Moderate ☐Severe

Structure displaced from foundation:
☐None/Minor ☐Moderate ☐Severe

Structure damaged by:
☐Wind ☐Water ☐Fire

DETERMINATIONK:

☐Primary structural components are sound. ☐More structural evaluation is necessary. ☐Primary structural components unsound.

Comments:

SIGNATURE:________________________

DATE:______________________________

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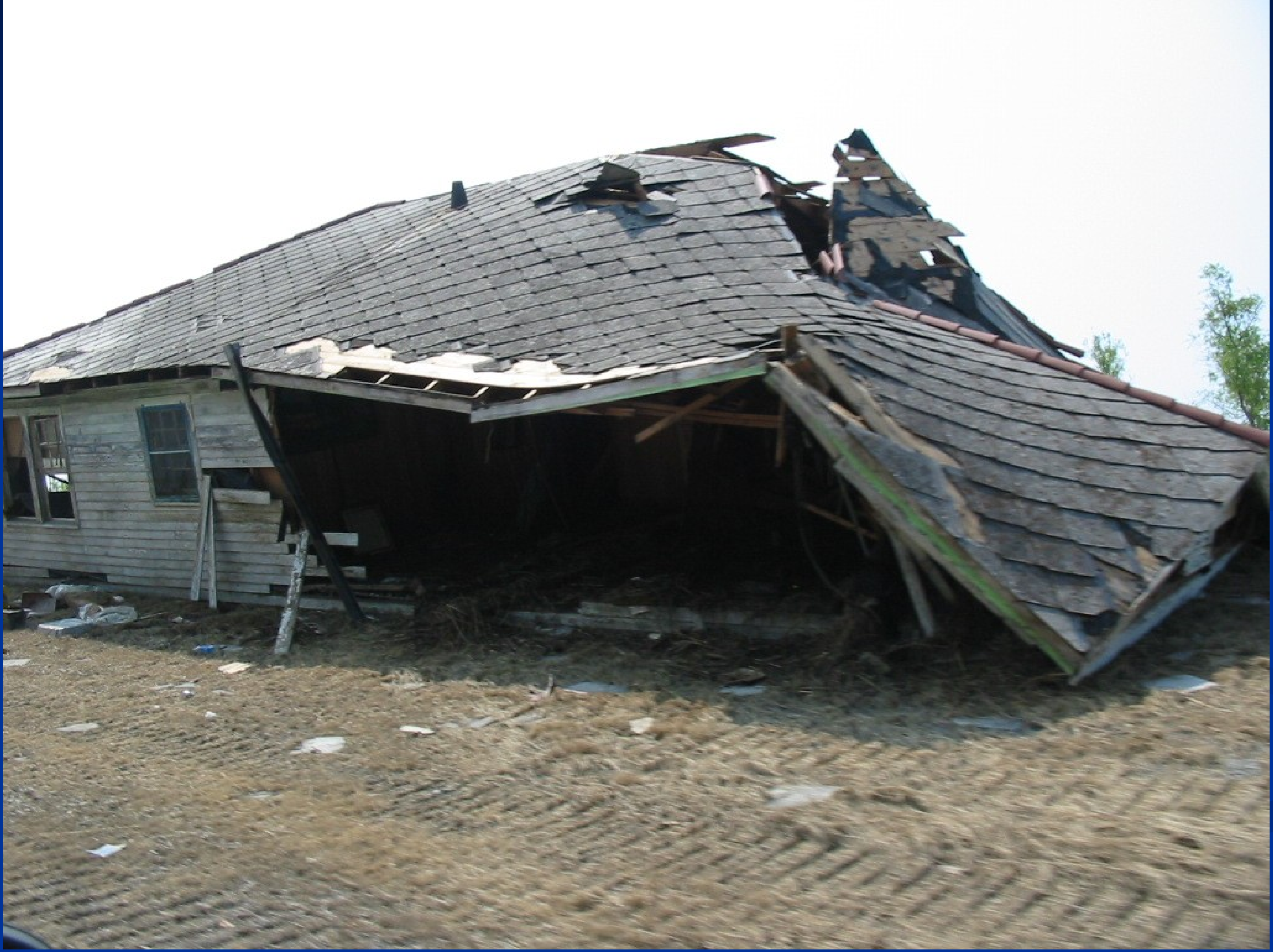
Rapid Assessment



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Rapid Assessment

113
Emergency Operations

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Rapid Assessment

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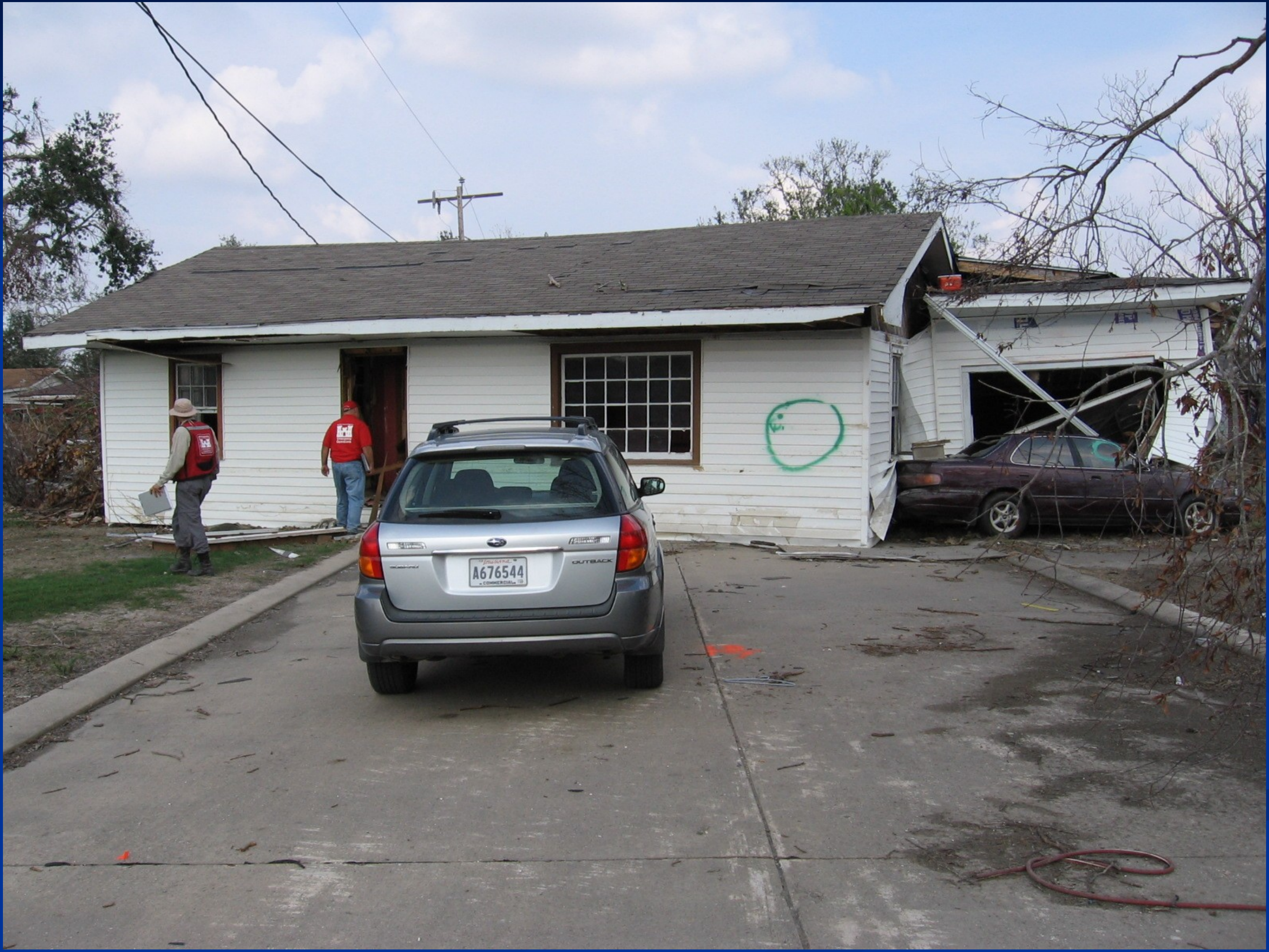
Rapid Assessment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OUTBACK

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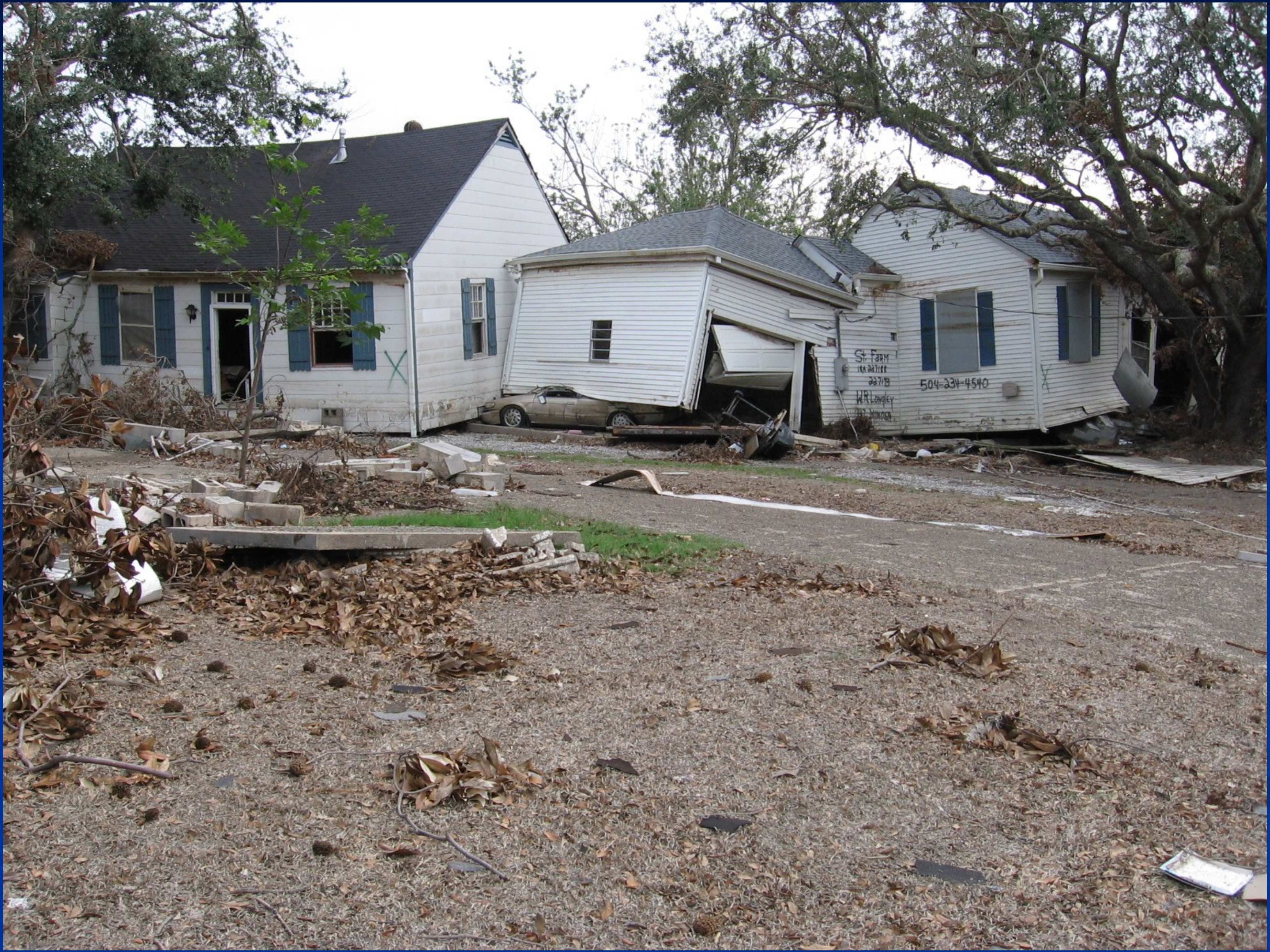
Rapid Assessment


St Farm
22713
W.R Longley
504-234-4540

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Visual Inspections

Visual Inspections

- Properties and homes that were no longer present or already collapsed

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Visual Inspections

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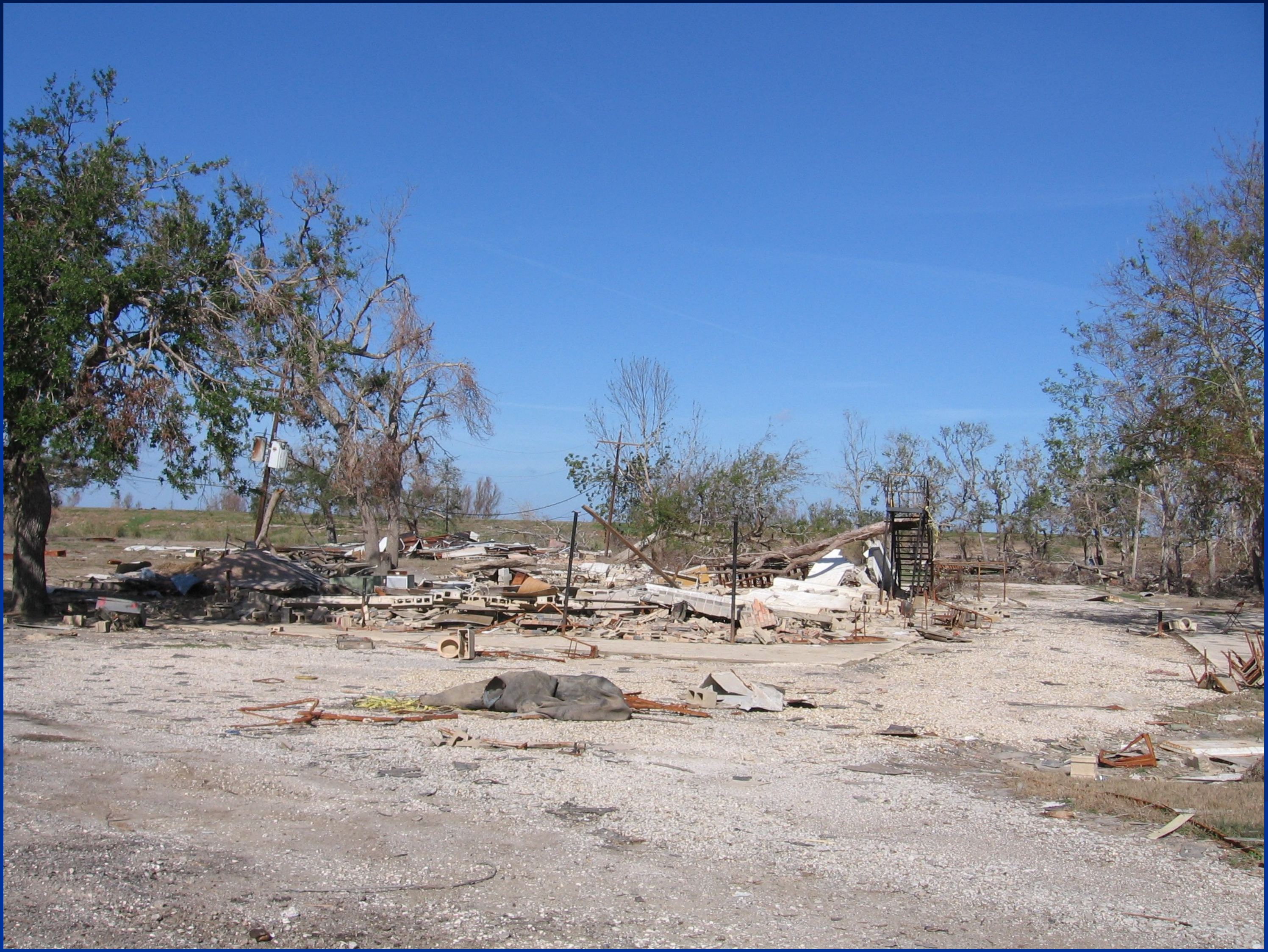
Visual Inspections



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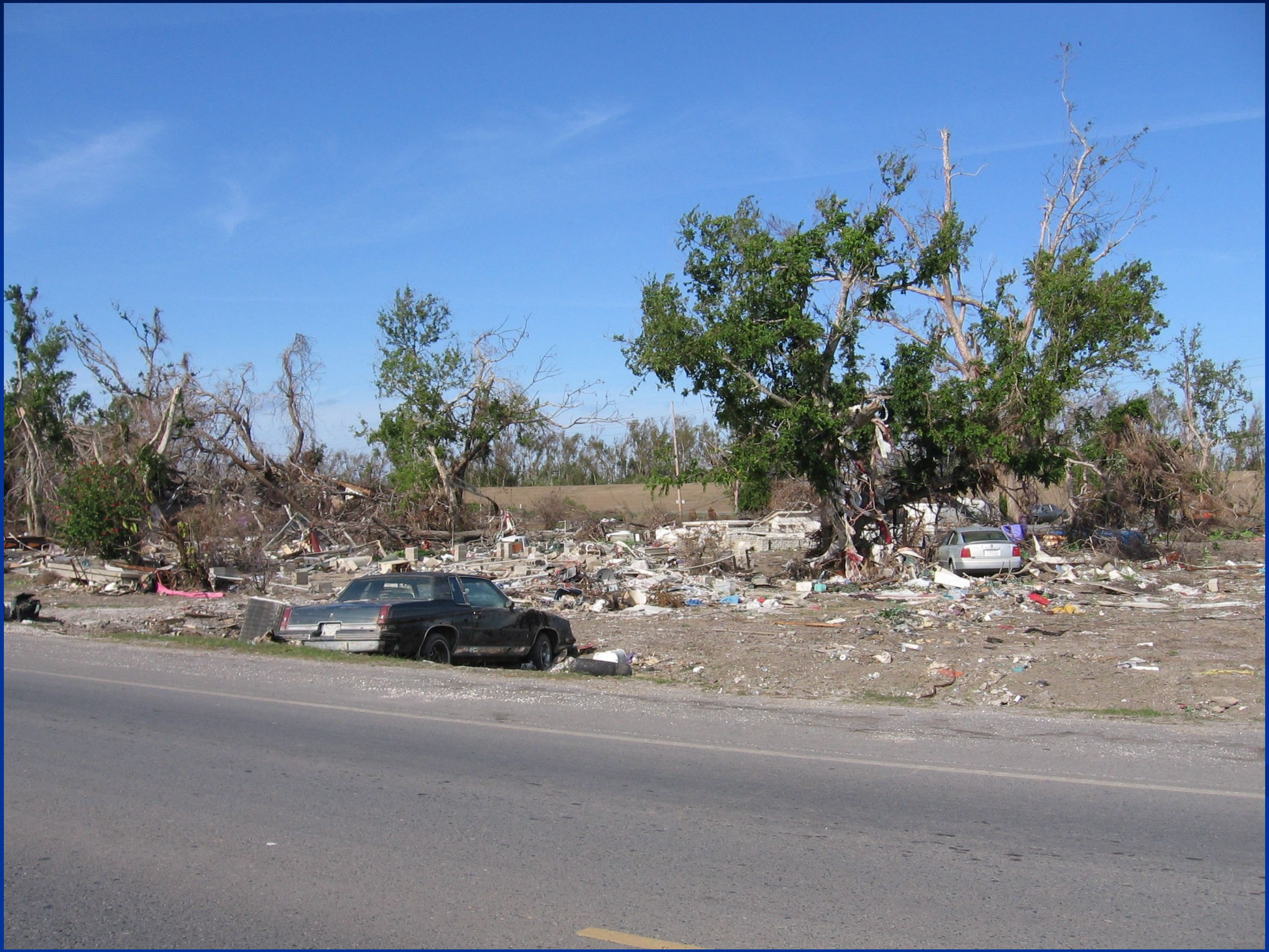

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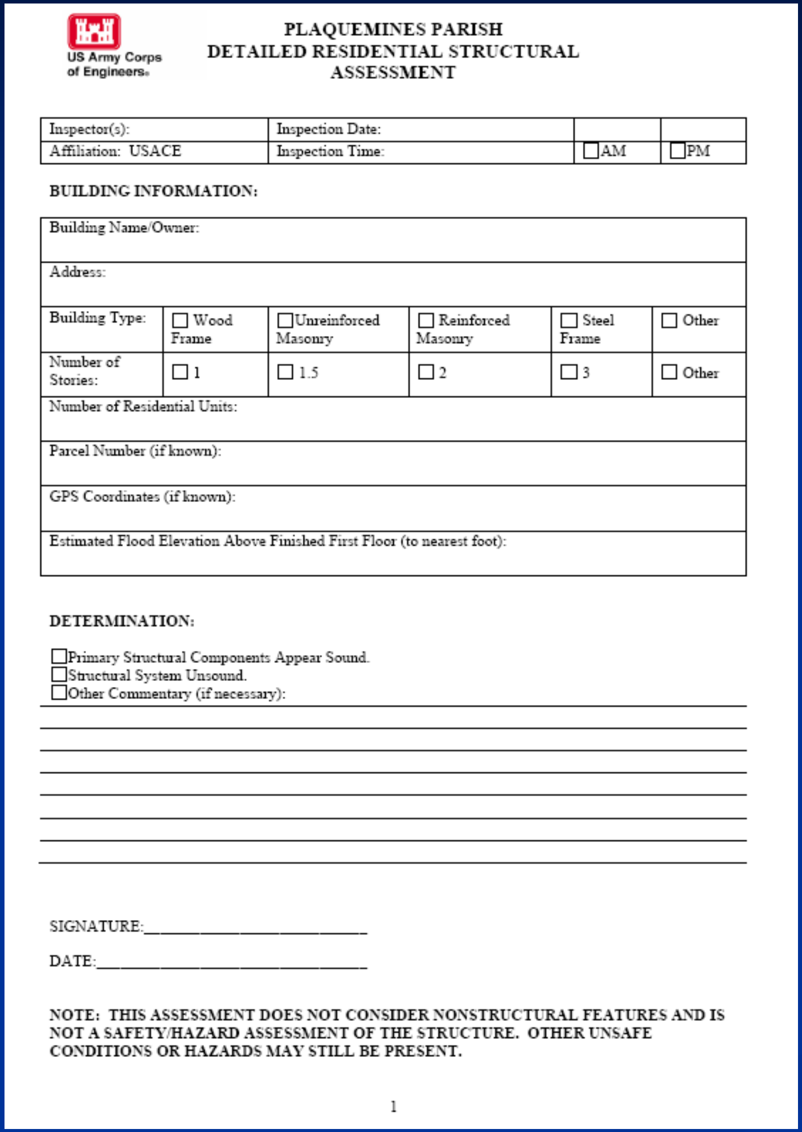
Detailed Residential Assessment



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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL
ASSESSMENT

Inspector(s):	Inspection Date:		
Affiliation: USACE	Inspection Time:	☐AM	☐PM

BUILDING INFORMATION:

Building Name/Owner:					
Address:					
Building Type:	☐ Wood Frame	☐Unreinforced Masonry	☐ Reinforced Masonry	☐ Steel Frame	☐ Other
Number of Stories:	☐ 1	☐ 1.5	☐ 2	☐ 3	☐ Other
Number of Residential Units:					
Parcel Number (if known):					
GPS Coordinates (if known):					
Estimated Flood Elevation Above Finished First Floor (to nearest foot):					

DETERMINATION:

☐Primary Structural Components Appear Sound.
☐Structural System Unsound.
☐Other Commentary (if necessary):

SIGNATURE:________________________

DATE:_____________________________

NOTE: THIS ASSESSMENT DOES NOT CONSIDER NONSTRUCTURAL FEATURES AND IS NOT A SAFETY/HAZARD ASSESSMENT OF THE STRUCTURE. OTHER UNSAFE CONDITIONS OR HAZARDS MAY STILL BE PRESENT.

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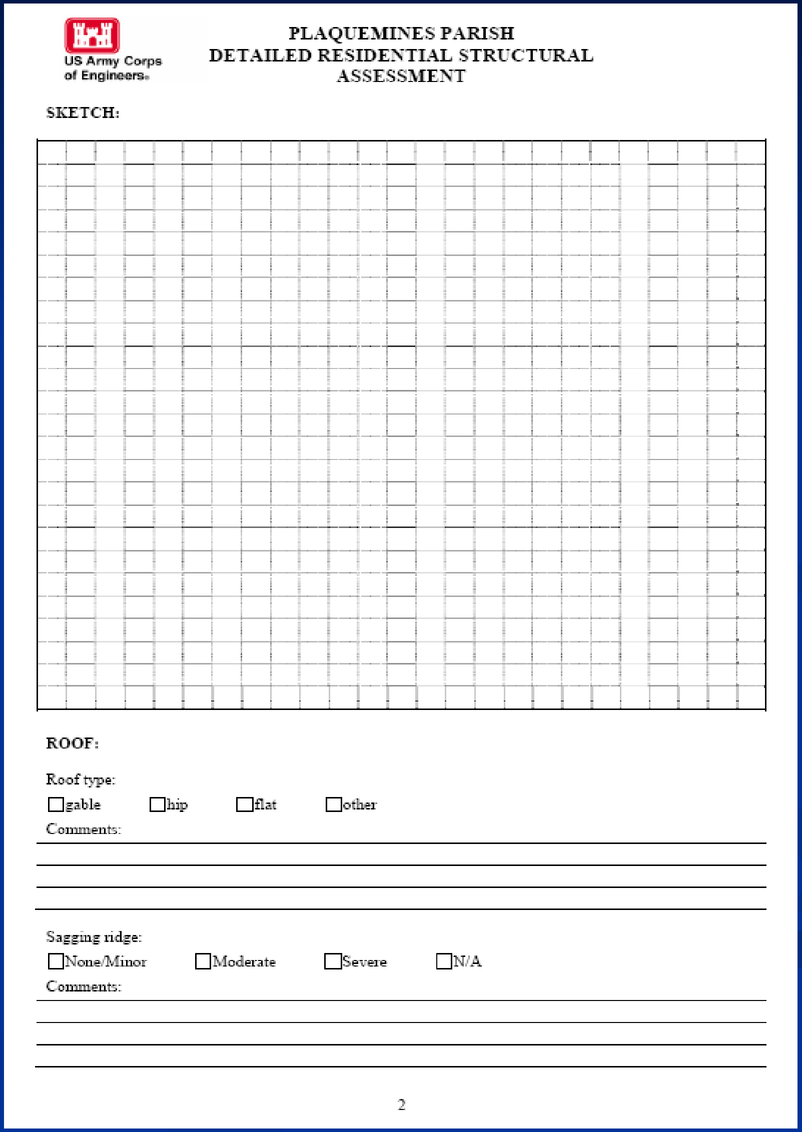

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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL
ASSESSMENT

SKETCH:

ROOF:

Roof type:

☐gable ☐hip ☐flat ☐other

Comments:

Sagging ridge:

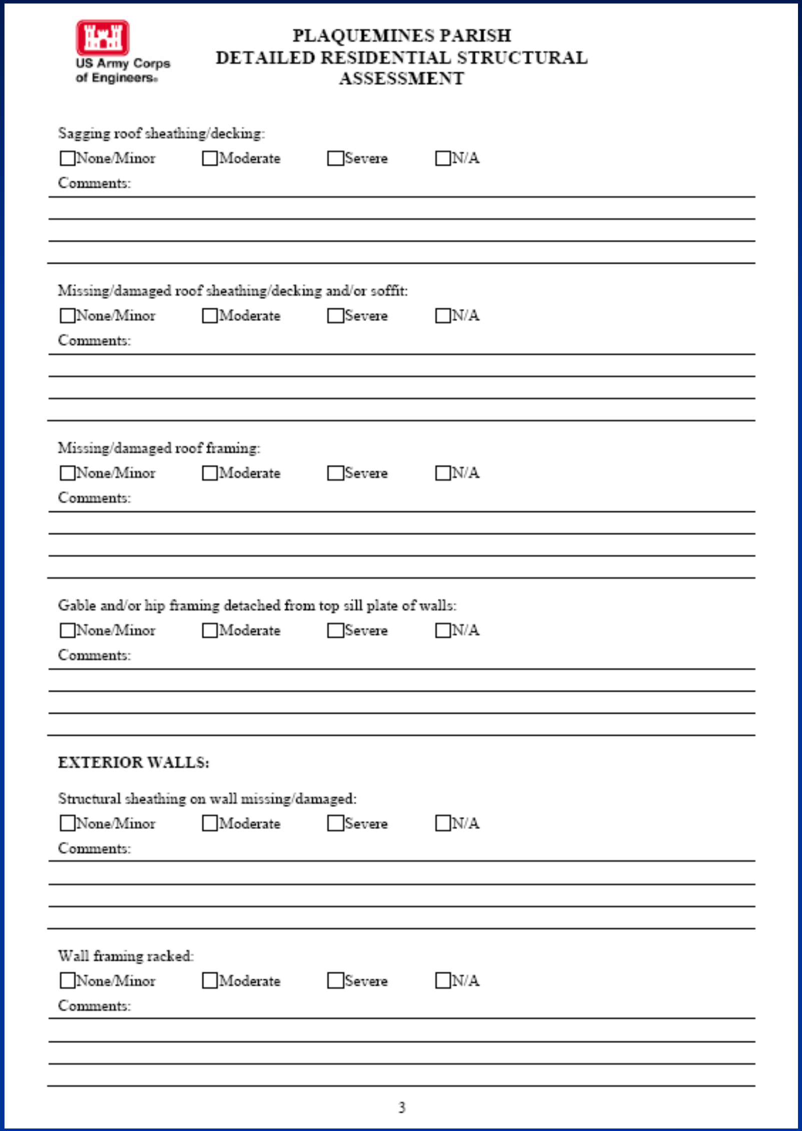
☐None/Minor ☐Moderate ☐Severe ☐N/A

Comments:

2

SSA-PRT Plaquemines Parish

Detailed Residential Assessment



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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL
ASSESSMENT

Sagging roof sheathing/decking:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

Missing/damaged roof sheathing/decking and/or soffit:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

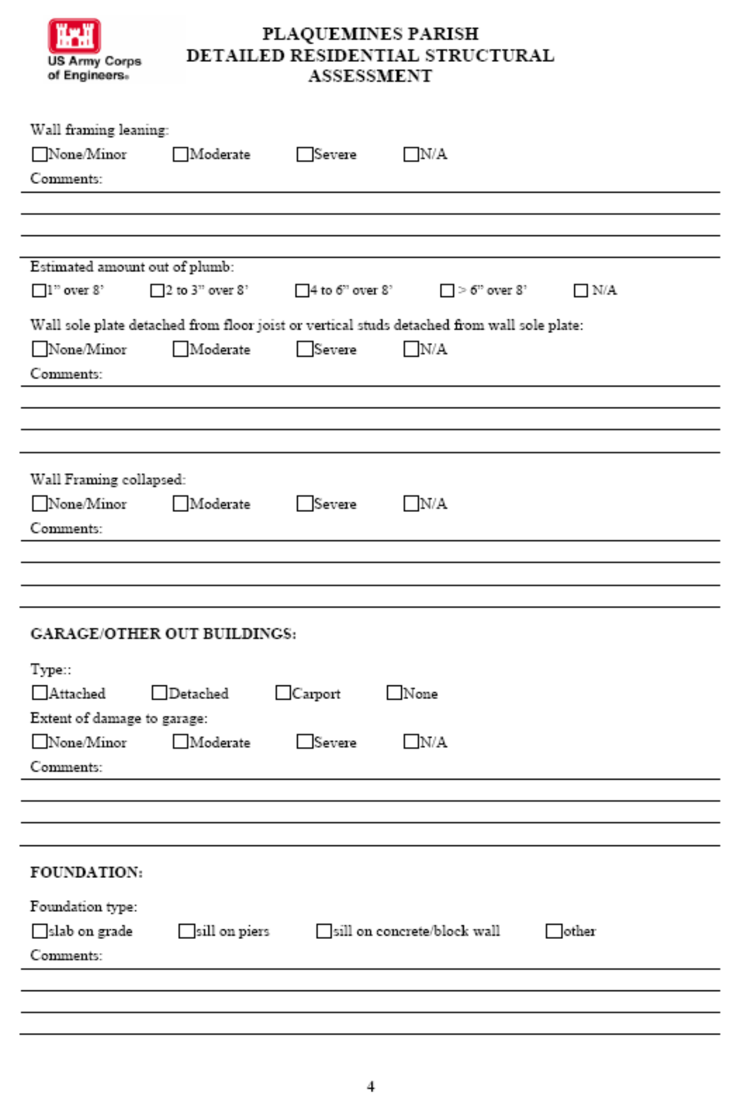
Missing/damaged roof framing:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

Gable and/or hip framing detached from top sill plate of walls:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

EXTERIOR WALLS:

Structural sheathing on wall missing/damaged:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

Wall framing racked:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:



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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL
ASSESSMENT

Wall framing leaning:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

Estimated amount out of plumb:
☐1" over 8' ☐2 to 3" over 8' ☐4 to 6" over 8' ☐ > 6" over 8' ☐ N/A

Wall sole plate detached from floor joist or vertical studs detached from wall sole plate:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

Wall Framing collapsed:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

GARAGE/OTHER OUT BUILDINGS:

Type::
☐Attached ☐Detached ☐Carport ☐None
Extent of damage to garage:
☐None/Minor ☐Moderate ☐Severe ☐N/A
Comments:

FOUNDATION:

Foundation type:
☐slab on grade ☐sill on piers ☐sill on concrete/block wall ☐other
Comments:

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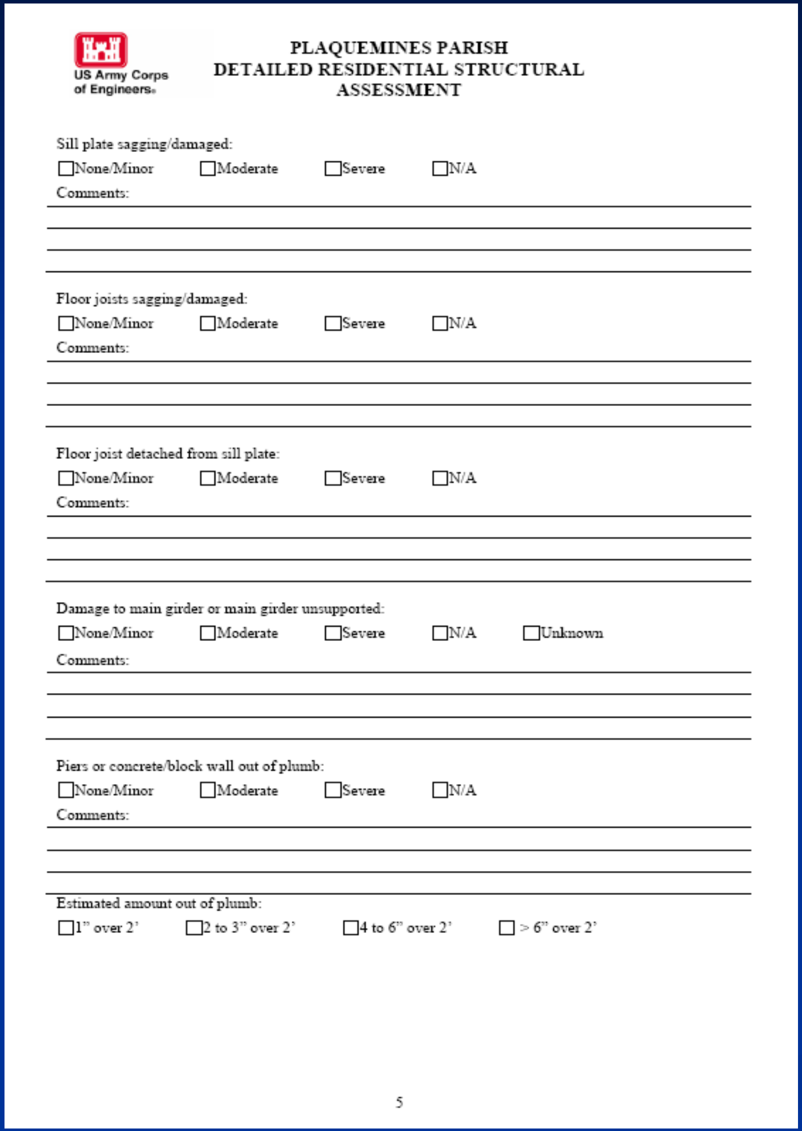
Detailed Residential Assessment



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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL ASSESSMENT

Sill plate sagging/damaged:

☐None/Minor ☐Moderate ☐Severe ☐N/A

Comments:

Floor joists sagging/damaged:

☐None/Minor ☐Moderate ☐Severe ☐N/A

Comments:

Floor joist detached from sill plate:

☐None/Minor ☐Moderate ☐Severe ☐N/A

Comments:

Damage to main girder or main girder unsupported:

☐None/Minor ☐Moderate ☐Severe ☐N/A ☐Unknown

Comments:

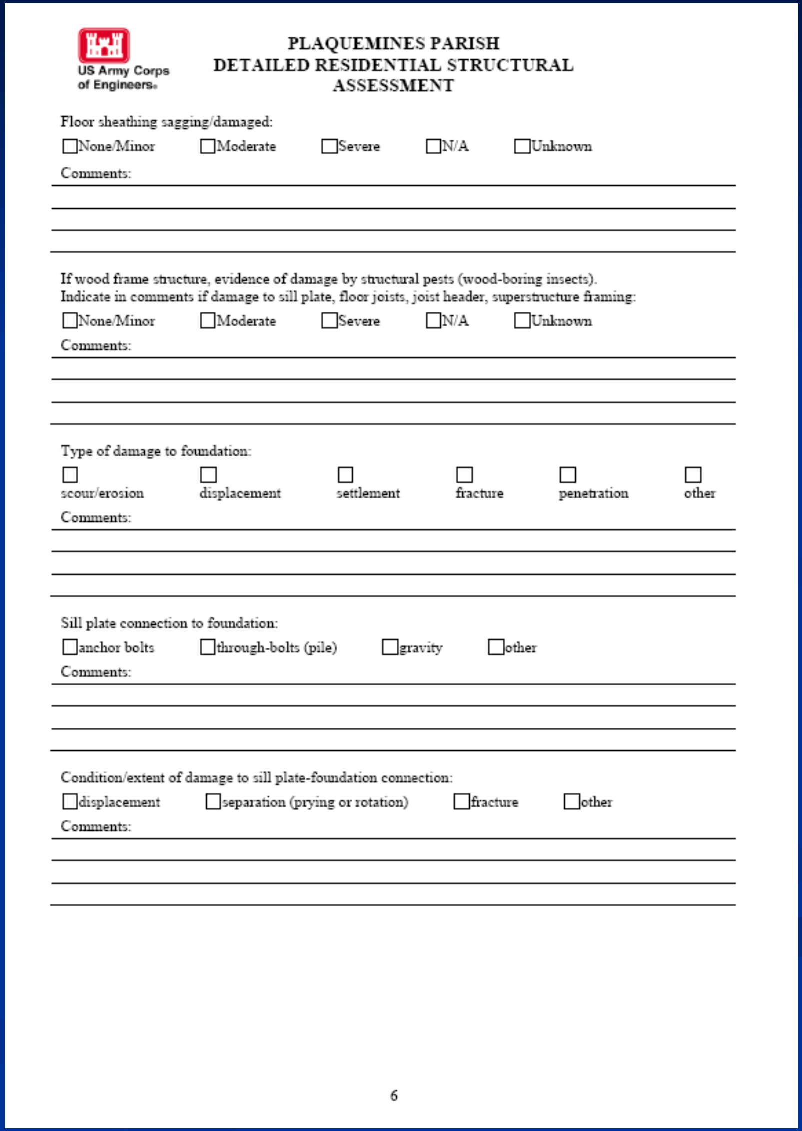
Piers or concrete/block wall out of plumb:

☐None/Minor ☐Moderate ☐Severe ☐N/A

Comments:

Estimated amount out of plumb:

☐1" over 2' ☐2 to 3" over 2' ☐4 to 6" over 2' ☐ > 6" over 2'



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PLAQUEMINES PARISH
DETAILED RESIDENTIAL STRUCTURAL ASSESSMENT

Floor sheathing sagging/damaged:

☐None/Minor ☐Moderate ☐Severe ☐N/A ☐Unknown

Comments:

If wood frame structure, evidence of damage by structural pests (wood-boring insects).
Indicate in comments if damage to sill plate, floor joists, joist header, superstructure framing:

☐None/Minor ☐Moderate ☐Severe ☐N/A ☐Unknown

Comments:

Type of damage to foundation:

☐ scour/erosion ☐ displacement ☐ settlement ☐ fracture ☐ penetration ☐ other

Comments:

Sill plate connection to foundation:

☐anchor bolts ☐through-bolts (pile) ☐gravity ☐other

Comments:

Condition/extent of damage to sill plate-foundation connection:

☐displacement ☐separation (prying or rotation) ☐fracture ☐other

Comments:

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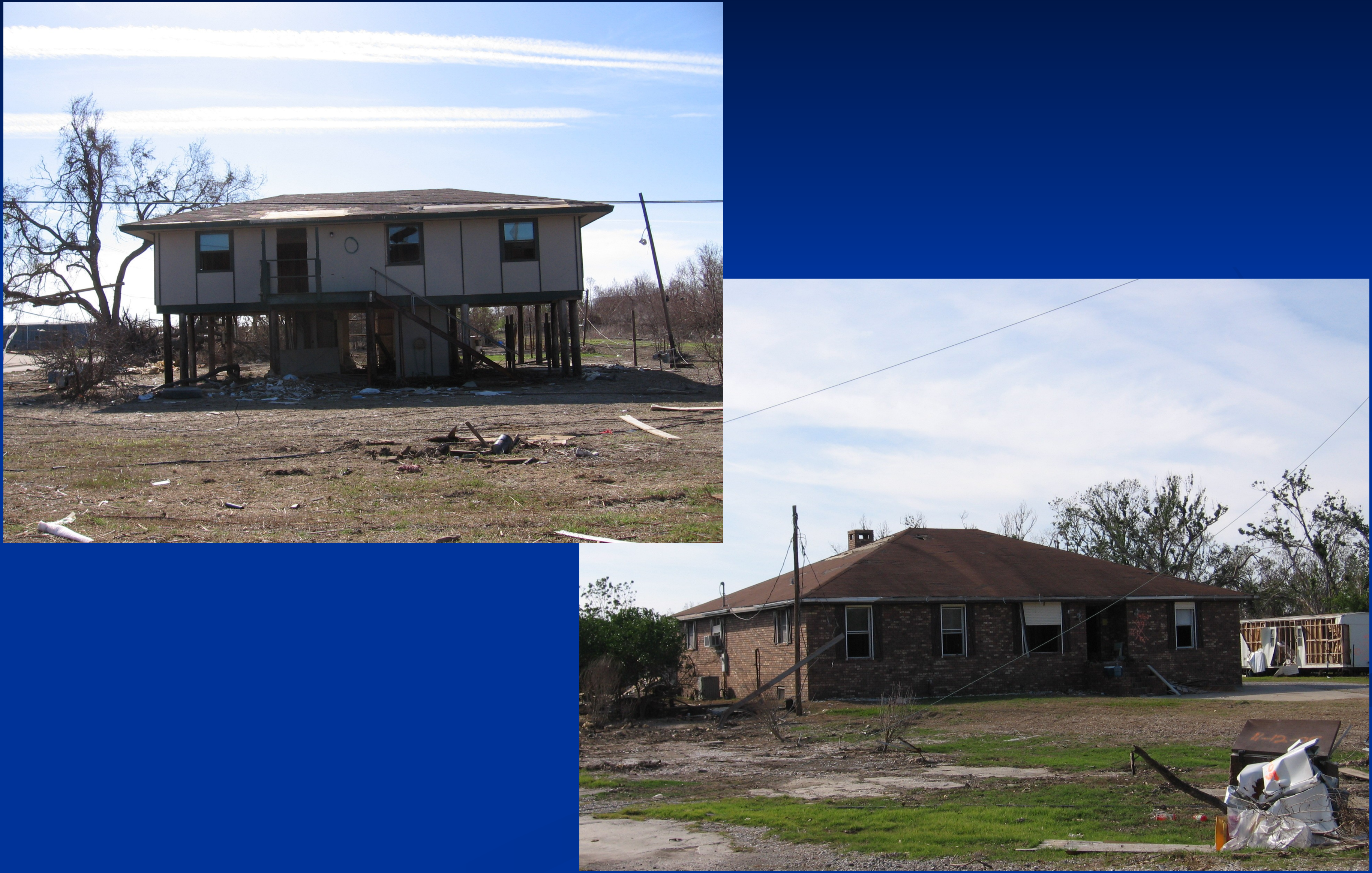
Detailed Residential Assessment



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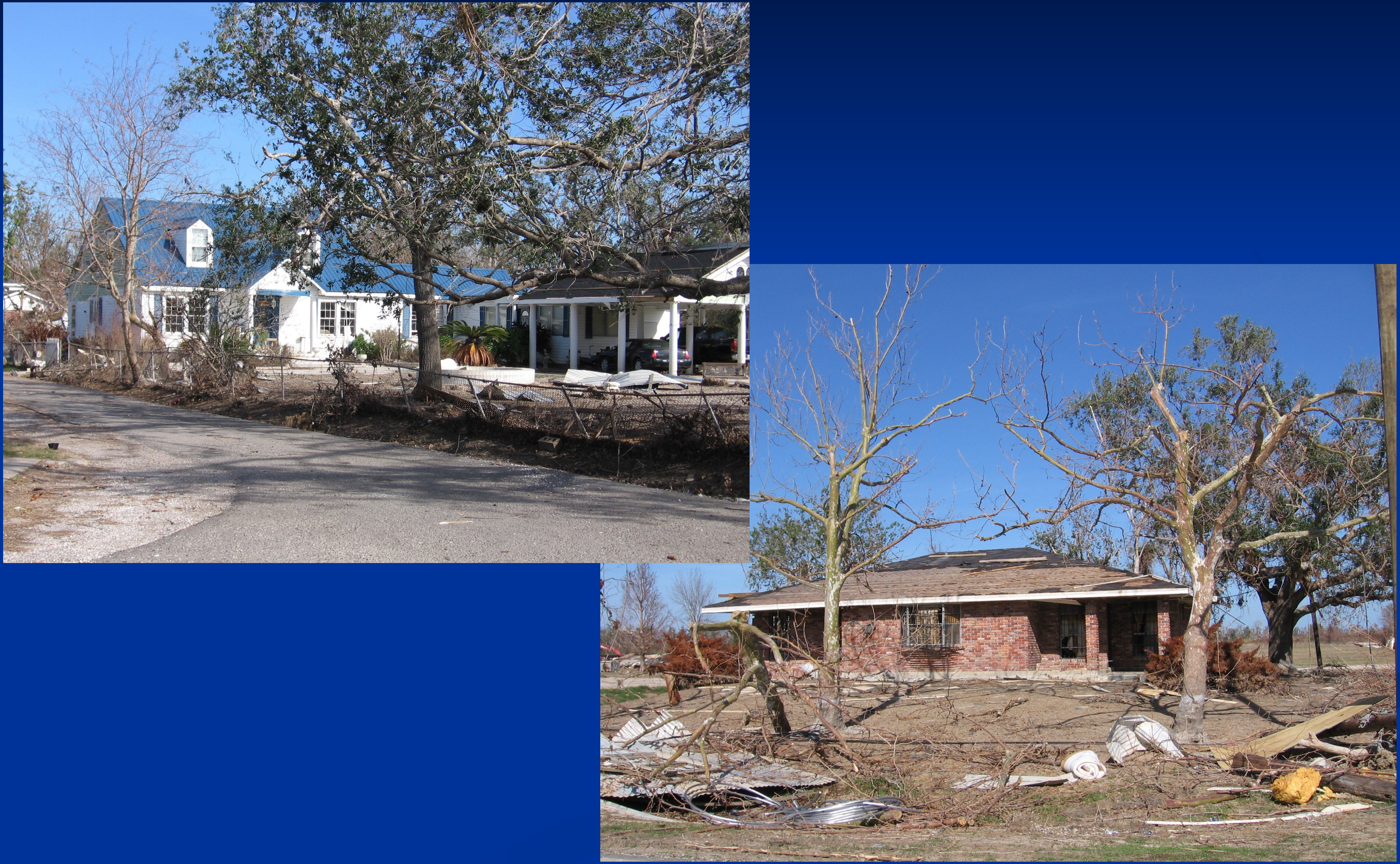

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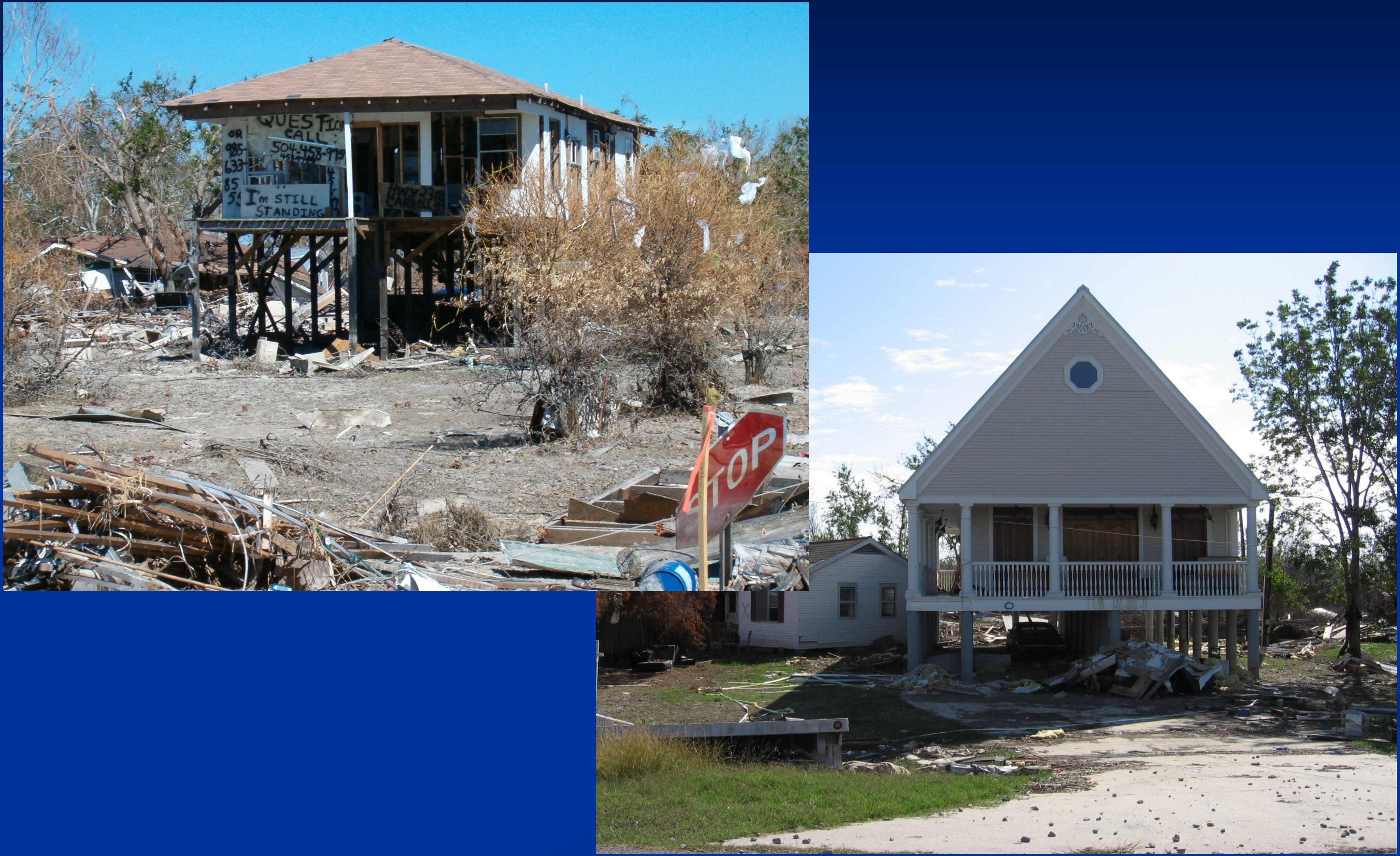
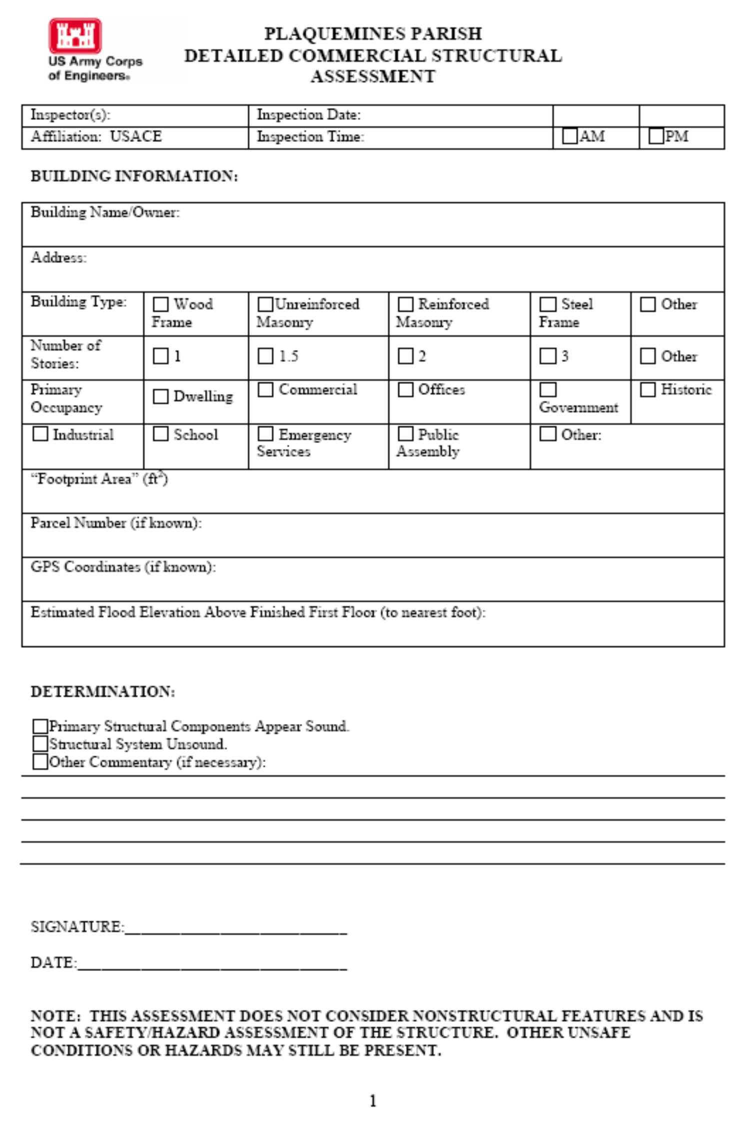

QUESTION CALL
504-458-979
OR 985-633-85
I'm STILL STANDING
STOP

SSA-PRT Plaquemines Parish
Detailed Commercial Assessment



US Army Corps of Engineers

PLAQUEMINES PARISH
DETAILED COMMERCIAL STRUCTURAL
ASSESSMENT

Inspector(s):	Inspection Date:		
Affiliation: USACE	Inspection Time:	☐AM	☐PM

BUILDING INFORMATION:

Building Name/Owner:					
Address:					
Building Type:	☐ Wood Frame	☐Unreinforced Masonry	☐ Reinforced Masonry	☐ Steel Frame	☐ Other
Number of Stories:	☐ 1	☐ 1.5	☐ 2	☐ 3	☐ Other
Primary Occupancy	☐ Dwelling	☐ Commercial	☐ Offices	☐ Government	☐ Historic
☐ Industrial	☐ School	☐ Emergency Services	☐ Public Assembly	☐ Other:	
"Footprint Area" (ft^2)					
Parcel Number (if known):					
GPS Coordinates (if known):					
Estimated Flood Elevation Above Finished First Floor (to nearest foot):					

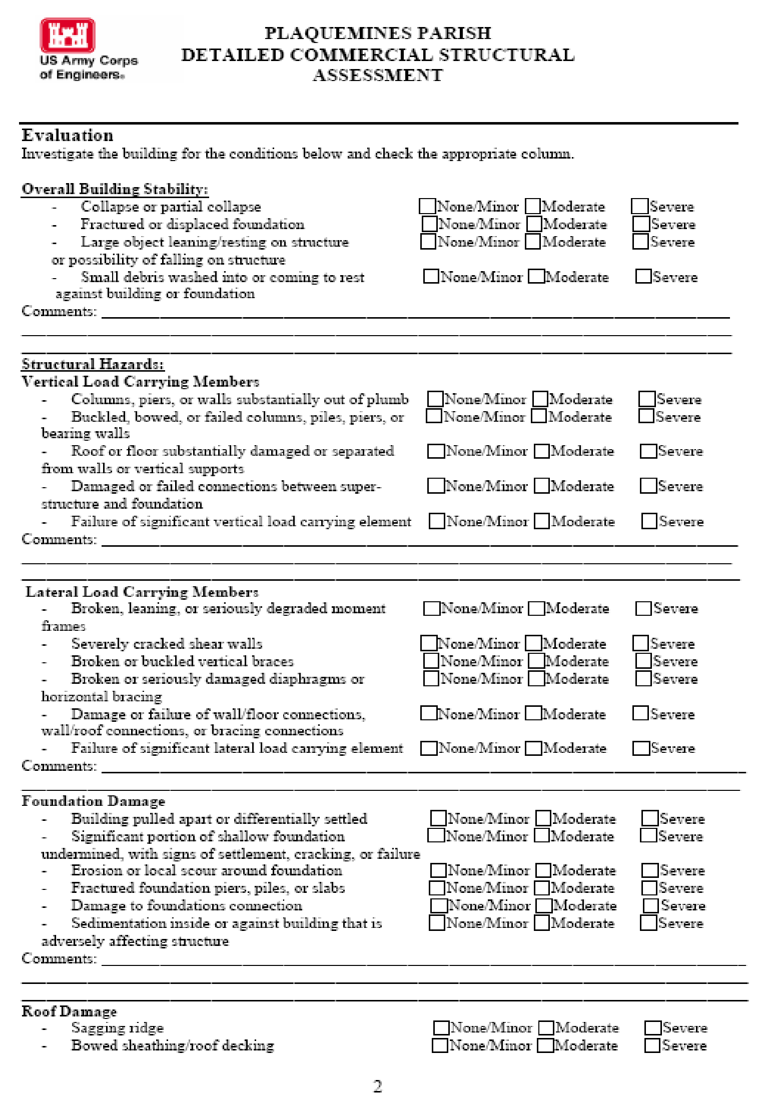
DETERMINATION:

☐Primary Structural Components Appear Sound.
☐Structural System Unsound.
☐Other Commentary (if necessary):
____
____
____
____
____

SIGNATURE:_________________________

DATE:_____________________________

NOTE: THIS ASSESSMENT DOES NOT CONSIDER NONSTRUCTURAL FEATURES AND IS NOT A SAFETY/HAZARD ASSESSMENT OF THE STRUCTURE. OTHER UNSAFE CONDITIONS OR HAZARDS MAY STILL BE PRESENT.



US Army Corps of Engineers

PLAQUEMINES PARISH
DETAILED COMMERCIAL STRUCTURAL
ASSESSMENT

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Overall Building Stability:

- Collapse or partial collapse ☐None/Minor ☐Moderate ☐Severe
- Fractured or displaced foundation ☐None/Minor ☐Moderate ☐Severe
- Large object leaning/resting on structure or possibility of falling on structure ☐None/Minor ☐Moderate ☐Severe
- Small debris washed into or coming to rest against building or foundation ☐None/Minor ☐Moderate ☐Severe

Comments: ____
____
____

Structural Hazards:

Vertical Load Carrying Members

- Columns, piers, or walls substantially out of plumb ☐None/Minor ☐Moderate ☐Severe
- Buckled, bowed, or failed columns, piles, piers, or bearing walls ☐None/Minor ☐Moderate ☐Severe
- Roof or floor substantially damaged or separated from walls or vertical supports ☐None/Minor ☐Moderate ☐Severe
- Damaged or failed connections between superstructure and foundation ☐None/Minor ☐Moderate ☐Severe
- Failure of significant vertical load carrying element ☐None/Minor ☐Moderate ☐Severe

Comments: ____
____
____

Lateral Load Carrying Members

- Broken, leaning, or seriously degraded moment frames ☐None/Minor ☐Moderate ☐Severe
- Severely cracked shear walls ☐None/Minor ☐Moderate ☐Severe
- Broken or buckled vertical braces ☐None/Minor ☐Moderate ☐Severe
- Broken or seriously damaged diaphragms or horizontal bracing ☐None/Minor ☐Moderate ☐Severe
- Damage or failure of wall/floor connections, wall/roof connections, or bracing connections ☐None/Minor ☐Moderate ☐Severe
- Failure of significant lateral load carrying element ☐None/Minor ☐Moderate ☐Severe

Comments: ____
____

Foundation Damage

- Building pulled apart or differentially settled ☐None/Minor ☐Moderate ☐Severe
- Significant portion of shallow foundation undermined, with signs of settlement, cracking, or failure ☐None/Minor ☐Moderate ☐Severe
- Erosion or local scour around foundation ☐None/Minor ☐Moderate ☐Severe
- Fractured foundation piers, piles, or slabs ☐None/Minor ☐Moderate ☐Severe
- Damage to foundations connection ☐None/Minor ☐Moderate ☐Severe
- Sedimentation inside or against building that is adversely affecting structure ☐None/Minor ☐Moderate ☐Severe

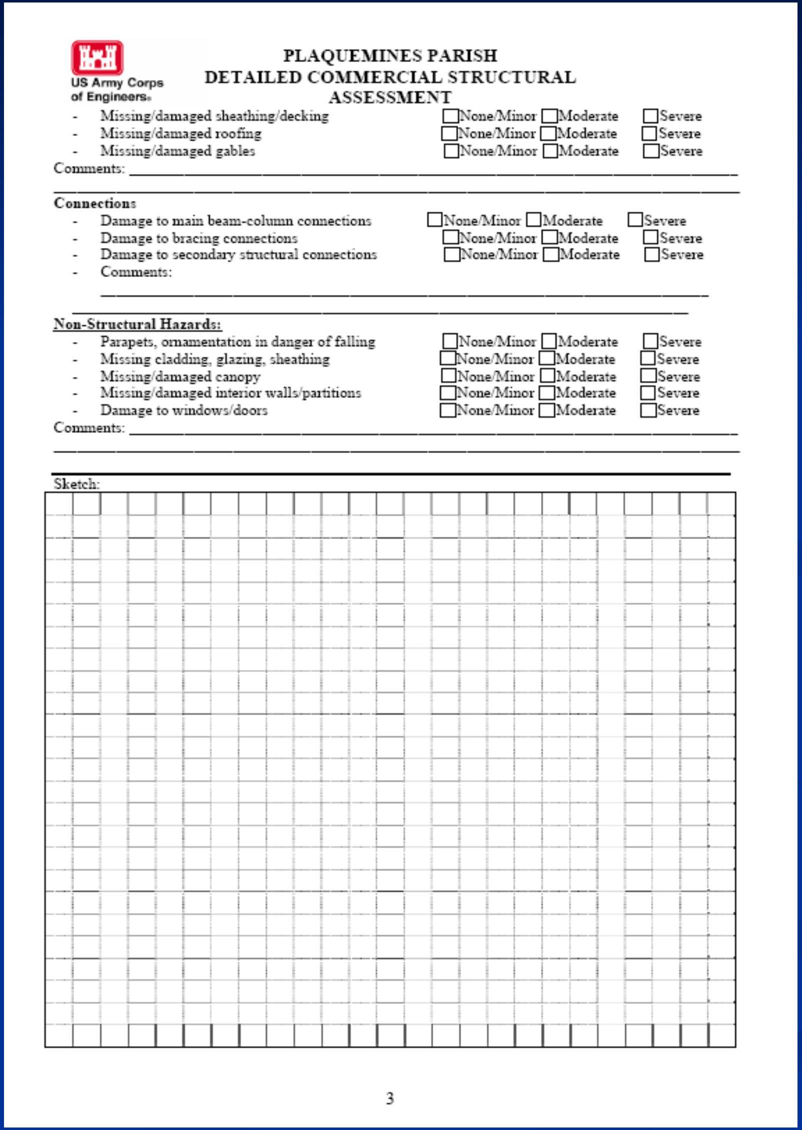
Comments: ____
____
____

Roof Damage

- Sagging ridge ☐None/Minor ☐Moderate ☐Severe
- Bowed sheathing/roof decking ☐None/Minor ☐Moderate ☐Severe

SSA-PRT Plaquemines Parish

Detailed Commercial Assessment



US Army Corps
of Engineers®

PLAQUEMINES PARISH
DETAILED COMMERCIAL STRUCTURAL
ASSESSMENT

- Missing/damaged sheathing/decking ☐None/Minor ☐Moderate ☐Severe
- Missing/damaged roofing ☐None/Minor ☐Moderate ☐Severe
- Missing/damaged gables ☐None/Minor ☐Moderate ☐Severe

Comments: ____
____

Connections

- Damage to main beam-column connections ☐None/Minor ☐Moderate ☐Severe
- Damage to bracing connections ☐None/Minor ☐Moderate ☐Severe
- Damage to secondary structural connections ☐None/Minor ☐Moderate ☐Severe
- Comments:

____
____

Non-Structural Hazards:

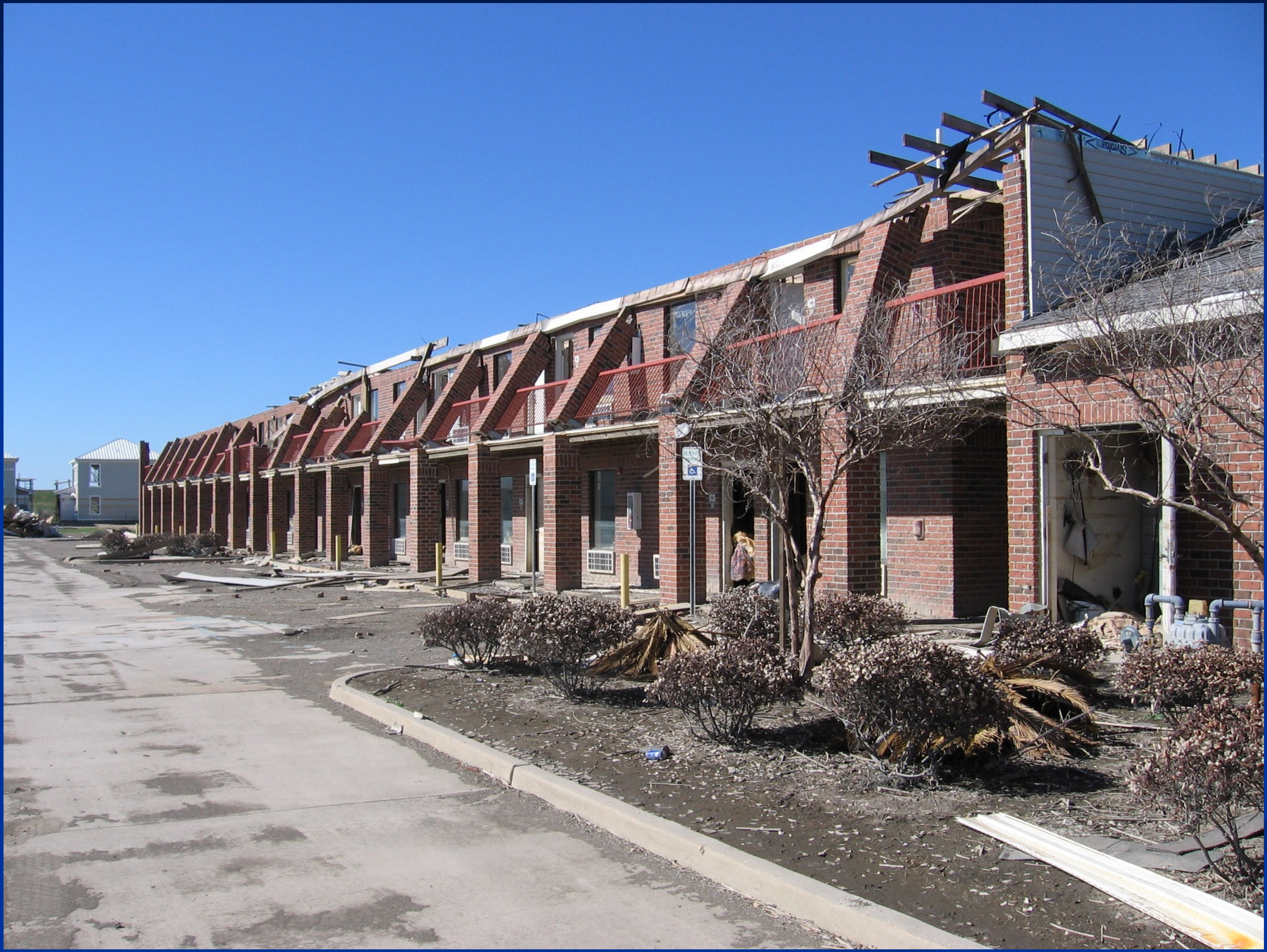
- Parapets, ornamentation in danger of falling ☐None/Minor ☐Moderate ☐Severe
- Missing cladding, glazing, sheathing ☐None/Minor ☐Moderate ☐Severe
- Missing/damaged canopy ☐None/Minor ☐Moderate ☐Severe
- Missing/damaged interior walls/partitions ☐None/Minor ☐Moderate ☐Severe
- Damage to windows/doors ☐None/Minor ☐Moderate ☐Severe

Comments: ____
____

Sketch:

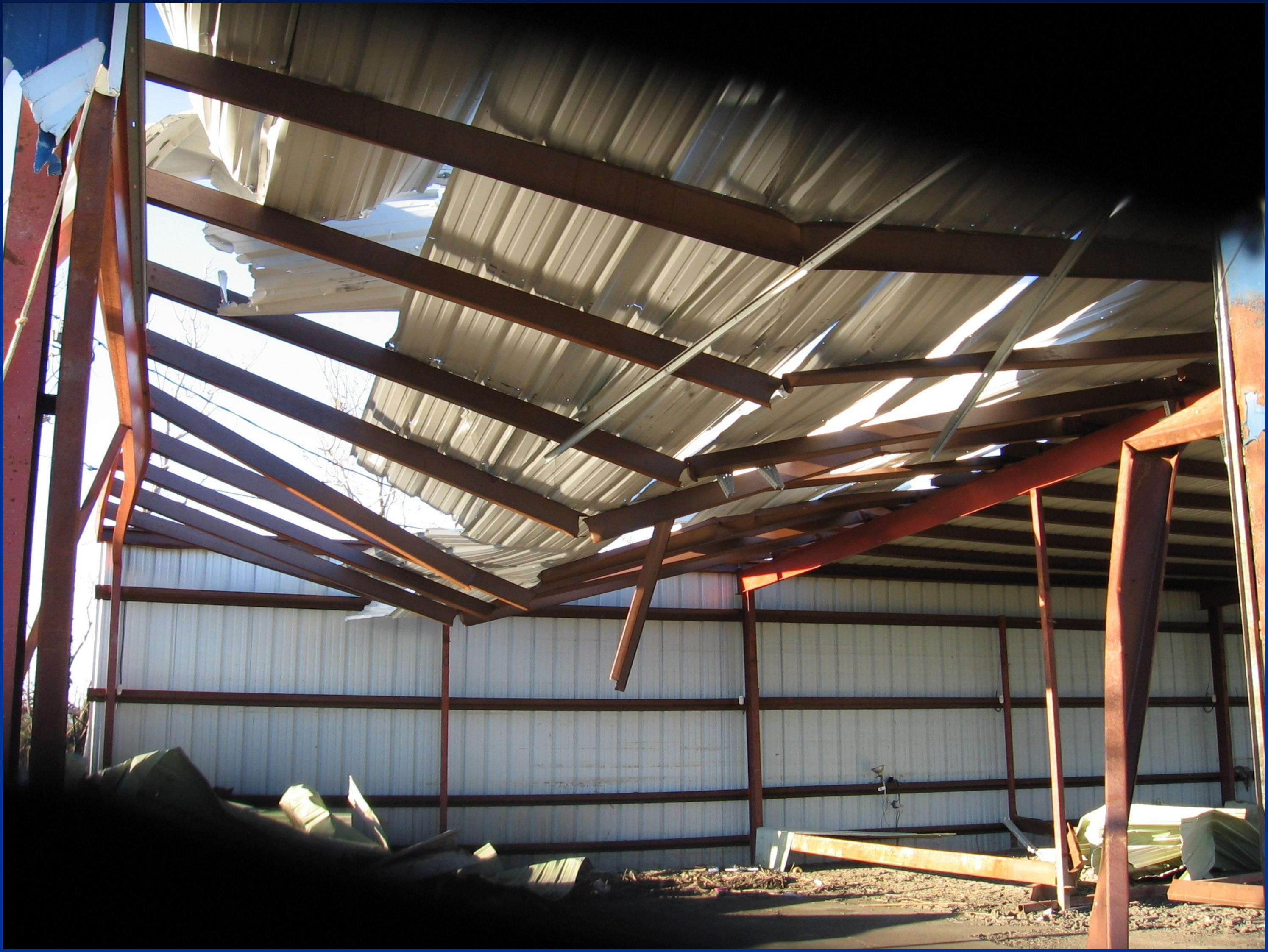
SSA-PRT Plaquemines Parish

Detailed Commercial Assessment



SSA-PRT Plaquemines Parish

Detailed Commercial Assessment



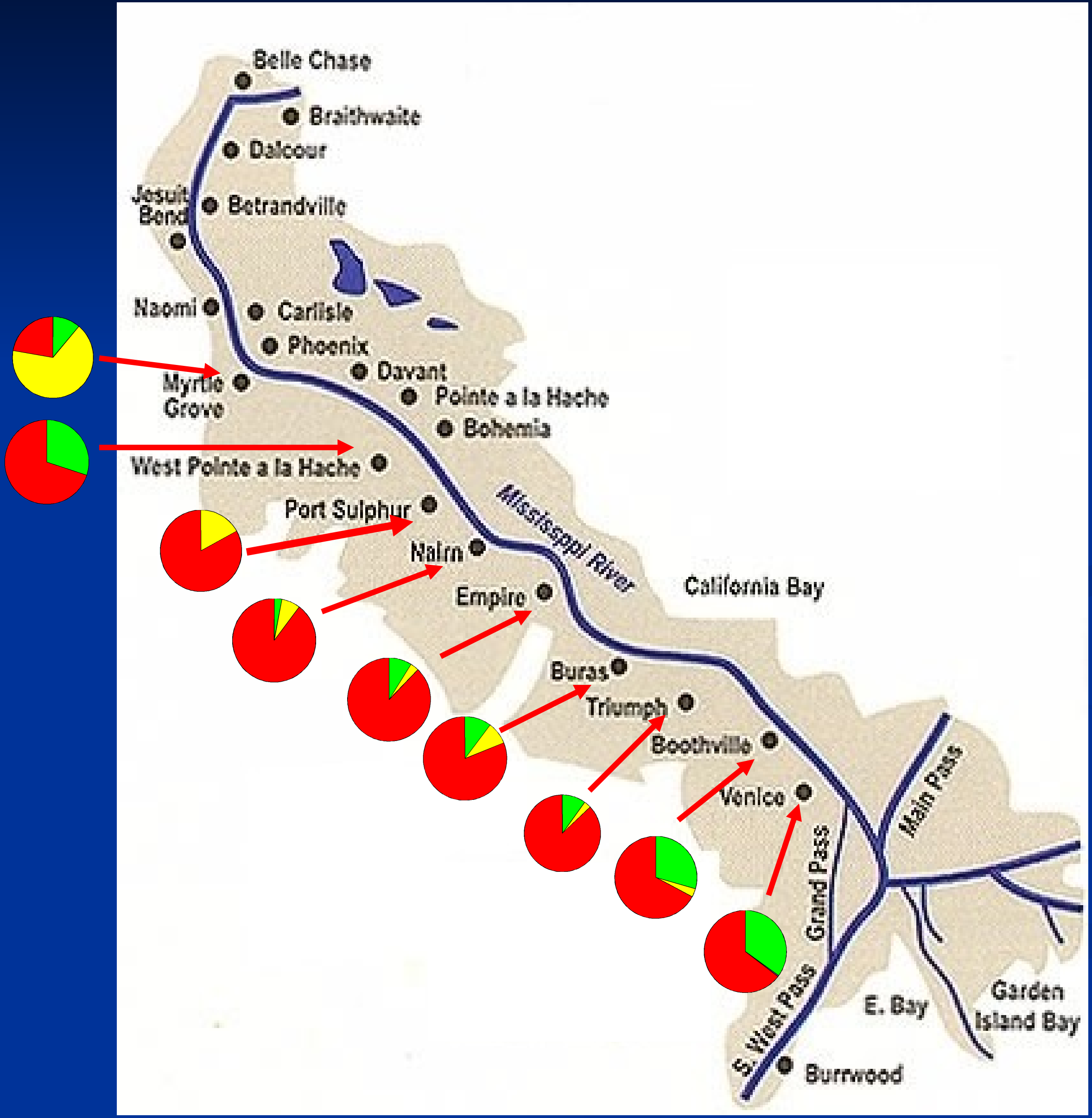
SSA-PRT Plaquemines Parish

Results for West Bank

Area	Rapid Insp.	Detailed Insp.	Visual Insp.	Structure Appears Sound	More Invs. Needed	Structure Appears Unsound
Ironton	0	6	0	2	0	4
Myrtle Grove	8	1	0	1	6	2
West Point	5	5	0	3	0	7
Diamond	58	8	0	5	6	55
Happy Jack	94	20	0	41	35	38
Enclade	276	7	70	5	30	318
Potash	102	10	262	5	30	339
Port Sulphur	33	1	49	0	14	69
Homeplace	112	10	69	3	34	154
Bremond	198	14	228	34	39	367
Nairn	200	6	95	9	22	270
Empire	207	12	522	65	25	651
Tropical Bend	55	0	132	0	0	187
Buras	507	20	504	107	88	836
Triumph	76	1	175	25	8	219
Boothville	565	8	576	338	38	773
Venice	158	20	144	113	1	208
TOTALS:	**2654**	**149**	**2826**	**756**	**376**	**4497**

SSA-PRT Plaquemines Parish

Results for West Bank


Belle Chase
Braithwaite
Dalcour
Jesuit Bend
Betrandville
Naomi
Carlisle
Phoenix
Davant
Myrtle Grove
Pointe a la Hache
Bohemia
West Pointe a la Hache
Port Sulphur
Nairn
Mississippi River
Empire
California Bay
Buras
Triumph
Boothville
Venice
Main Pass
Grand Pass
S. West Pass
E. Bay
Garden Island Bay
Burrwood

🟥 **Structure Appears Unsound**

🟨 **More Investigation Needed**

🟩 **Structure Appears Sound**

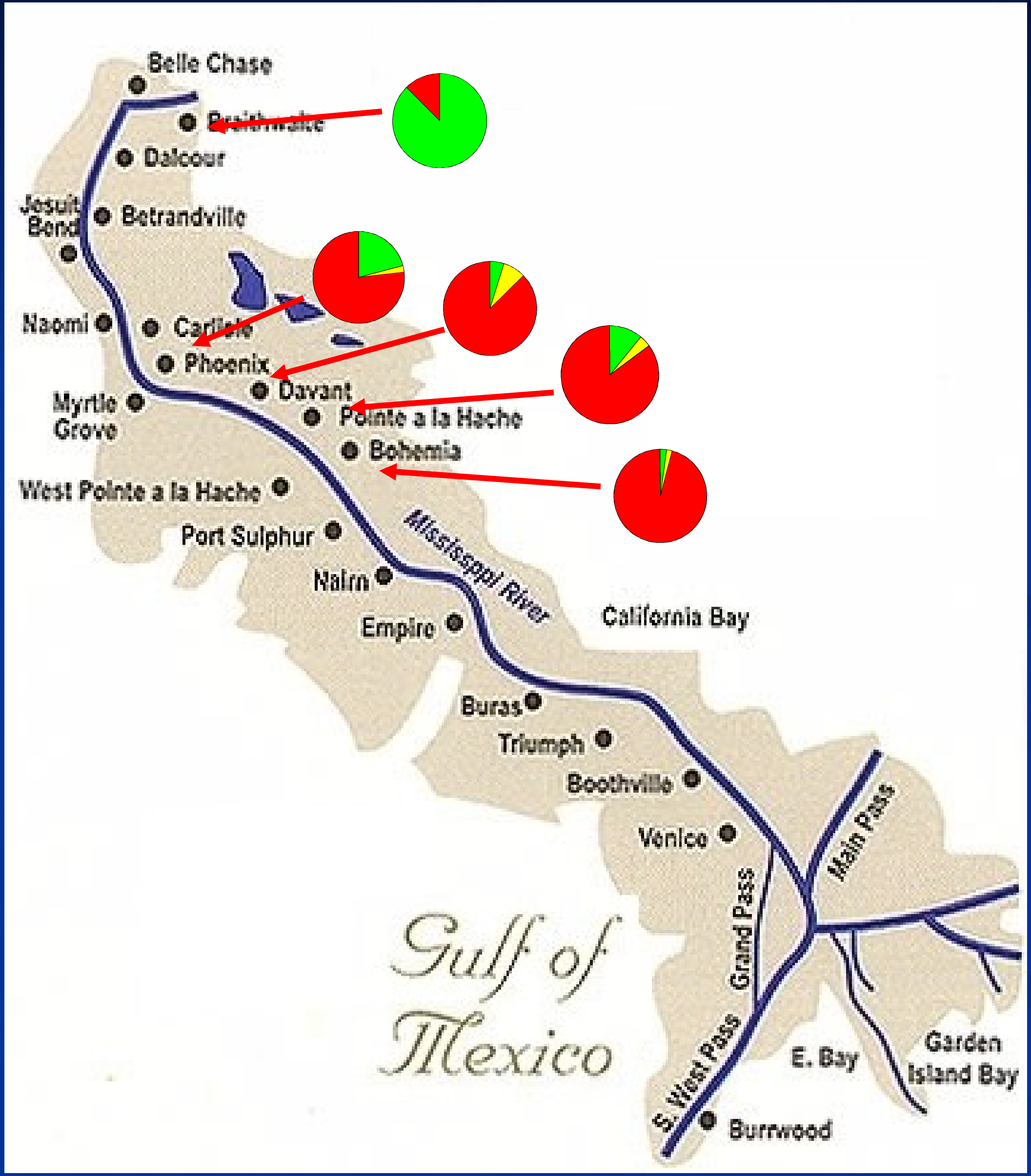
SSA-PRT Plaquemines Parish

Results for East Bank

Area	**Rapid Insp.**	**Detailed Insp.**	**Visual Insp.**	**Structure Appears Sound**	**More Invs. Needed**	**Structure Appears Unsound**
Point-a-la-Hache	59	2	181	27	9	206
Phoenix	183	7	40	48	5	177
Davant	95	3	122	11	17	192
Harlem	22	0	25	1	1	45
Belair/Carlisle	18	0	0	7	1	10
Braithwaite	0	8	0	7	0	1
TOTALS:	**377**	**20**	**368**	**101**	**33**	**631**

SSA-PRT Plaquemines Parish

Results for East Bank


Belle Chase
Braithwaite
Dalcour
Jesuit Bend
Betrandville
Naomi
Carlisle
Phoenix
Davant
Myrtle Grove
Pointe a la Hache
Bohemia
West Pointe a la Hache
Port Sulphur
Mississippi River
Nairn
Empire
California Bay
Buras
Triumph
Boothville
Venice
Main Pass
Grand Pass
Gulf of Mexico
S. West Pass
E. Bay
Garden Island Bay
Burrwood

🟥 **Structure Appears Unsound**

🟨 **More Investigation Needed**

🟩 **Structure Appears Sound**

SSA-PRT Plaquemines Parish

Overall Results

Area	Rapid Insp.	Detailed Insp.	Visual Insp.	Structure Appears Sound	More Investigation Needed	Structure Appears Unsound
East Bank	377	20	368	101	33	631
West Bank	2654	149	2826	756	375	4497
Total	**3031**	**169**	**3194**	**857**	**408**	**5128**

SSA-PRT Plaquemines Parish

QUESTIONS???